Industrial QUALITY CONTROL

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A Check Inspection and Demerit Rating Plan

On The Use of Theory

Mail Order Acceptance Sampling

Report of the Tenth Annual Convention

QUALITY
through
Scientific Methods

1946—TENTH ANNIVERSARY YEAR—1956

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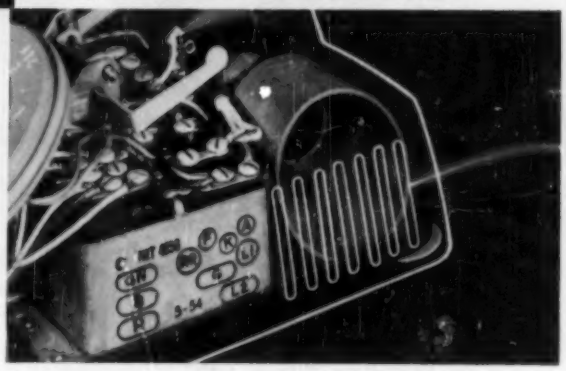

Above: Bell ringer has been displaced by a small loudspeaker in transistorized telephone. Left: L. A. Meacham heads the team of engineers that developed the musical tone ringer. Mr. Meacham holds a B.S. in Electrical Engineering from the University of Washington, Class of '29. He became affiliated with Bell Labs a year after his graduation. In 1939 Mr. Meacham won the "Outstanding Young Electrical Engineer" award of Eta Kappa Nu.

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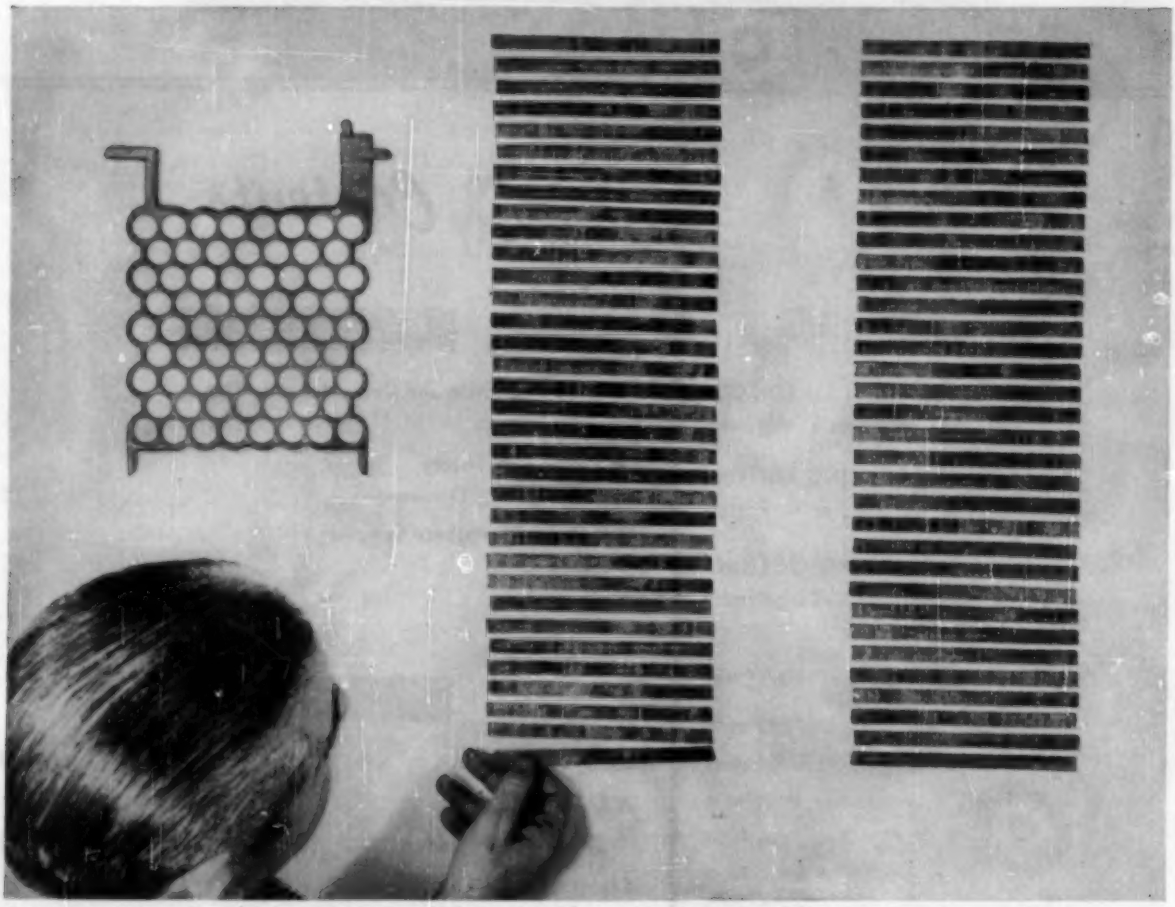
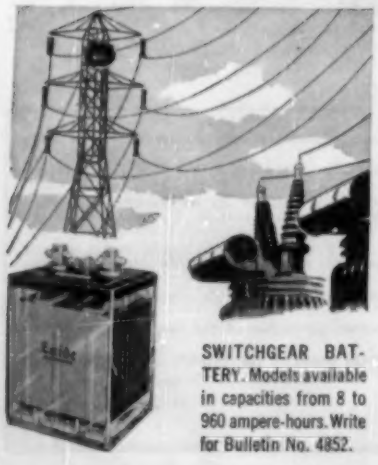
EXIDE-MANCHEX BATTERIES

For generating and substations



Actual photo of the unwound 68 spiral buttons from just one Exide-Manchex positive plate.

Enormous plate area multiplies battery life



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In the picture shown above, the spiral lead buttons from a single Exide-Manchex positive plate are unwound and laid flat on a table beside the empty grid. Look at the enormous actual plate area of the unrolled buttons—over five times as great as the plate size!

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Exide®

A Check Inspection and Demerit Rating Plan*

H. F. DODGE and M. N. TORREY

Bell Telephone Laboratories, Inc., New York, N. Y.

Introduction

An article by E. G. D. Paterson[1] has presented an over-all quality assurance plan used in the Bell System for assuring the quality of the varied kinds of communications apparatus and equipment being added to the telephone plant. The present article describes in some detail a particular segment of this over-all plan, namely, a check inspection and demerit rating plan that is applied to many of the telephone products that are manufactured within the Bell System in relatively large quantities.

A number of different inspection procedures are used in the quality assurance program. The type of procedure specified in individual cases and the character and quantity of inspection results required for quality assurance purposes depend on the nature of the product and the circumstances surrounding its procurement. Certain general patterns of approach are retained, however, in all these procedures.

When we know little or nothing about the quality of a product, when we have little prior information as to how it was manufactured, and when we do not know how much, if any, inspection was done before the material was offered for acceptance or whether adequate quality control techniques were used, we must utilize an inspection technique that will in itself tell us, within limits, whether a particular quantity or lot of product does or does not meet a suitable standard of quality. A procedure known as lot-by-lot acceptance sampling is commonly used in such cases. This is used for many of the products purchased from non-Bell sources.

Several types of lot acceptance sampling plans are available, as for example, those based on a fixed Consumer's Risk and a stated tolerance percent defective for individual lots[2], those based on a stated limiting value of average outgoing quality or AOQL[2], and those based on the concept of an acceptable quality level or AQL[3,4]. In general, these plans as applied in practice employ samples of substantial size and provide a relatively high degree of discrimination between lots of different quality.

A typical such plan involving double sampling is shown in Table I. This is an acceptance sampling plan for application to electrolytic capacitors, electronic components used in various types of communications equipment. Over 2,000,000 of these were purchased from outside sources in 1954 for Bell System use. They come in many varieties and in lot sizes that vary from less than 100 up to 10,000. The sampling plan shown is based upon a ten percent Consumer's Risk and a tolerance of three percent defective for individual lots[2] and covers collectively all of the characteristics listed at the right of Table I, as applicable in individual cases. Supplementary sampling plans cover certain other characteristics.

Referring to the sampling table, it is seen that, for a lot size of 300, the first sample size, n_1, is 75 and the first acceptance number, c_1, is 0. If no defectives are found in the first sample, the lot is accepted. If one defective is found in the first sample, a second sample of $n_2 = 40$ is selected and the lot may still be accepted if no additional defectives are found, since the second acceptance number, c_2, applying to cumulative results for both samples, is 1. But if 2 or more defectives are found in the first sample or in the first and second samples combined, this constitutes a failure to meet the acceptance criteria of the sampling plan and the lot is considered to be nonconforming. When a lot is found to be nonconforming, the normal procedure is to reject it. The manufacturer may then inspect the lot 100 percent, remove or repair the defective units, and resubmit it.

It is noted that the acceptance numbers apply to all of the listed characteristics collectively. This is accordingly a fairly strict sampling table. It has an AOQL of about 0.5 percent for small lots and about 0.7 percent for large lots. In other words, if rejected lots are inspected 100 percent and resubmitted after the removal of defects, this procedure may be expected to give an average outgoing quality of generally less than ½ percent defective with respect to these many characteristics considered collectively.

This general type of plan, a lot-by-lot acceptance sampling plan, provides a definite basis for discriminating between lots that can be considered conforming and those that must be considered nonconforming. As

TABLE I—Sampling Plan for Electrolytic Capacitors
(Lot Tolerance Percent Defective 3% [Table DL-3])

Lot Size	Sample Sizes			Acceptance No.		Characteristics Included (if pertinent)
	n_1	n_2	n_1+n_2	c_1	c_2	
1-40	All	—	—	0	—	Dimensions (Limited, Only)
41-55	40	—	—	0	—	Surface Inspection
56-100	55	—	—	0	—	Security and location of terminals;
101-150	70	30	100	0	1	Presence of: vent plugs,
151-300	75	40	115	0	1	insulating washer,
301-400	80	45	125	0	1	lockwasher, mounting nut, mounting clamp and associated screw,
401-600	85	50	135	0	1	nut, washer;
601-800	90	50	140	0	1	Threaded portion of cover;
801-1000	90	55	145	0	1	Security of cap. element;
1001-3000	90	60	150	0	1	Markings;
3001-100000	95	105	200	0	2	Finish.
						Tests
						Insulation breakdown;
						Leakage current at room temperature;
						Capacitance;
						Equivalent series resistance;
						Power factor.

*Presented at the Ninth Annual Convention of the American Society for Quality Control, New York, May 23, 1955 as a companion paper to "An Over-All Quality Assurance Plan" by E. G. Paterson, which was published in the May 1956 issue of this journal.

mentioned before, this type of plan is used when there is little or no prior information about a product or its background.

Now in contrast, when we have substantial prior knowledge about the product being furnished, specifically when the manufacturer's processes are normally well controlled, and the product has undergone adequate prior inspections to acceptable defect tolerances by capable employees using reliable gages and test sets, then we can employ, for quality assurance purposes, inspection of a very different character and of greatly curtailed extent. These favorable circumstances apply in general to telephone products manufactured by the Western Electric Company. Here we apply what is called a "check inspection" plan, sometimes referred to as an "audit" inspection, which will now be described in some detail.

Check Inspection Plan

Under this check inspection plan, inspection is carried out on the manufacturer's premises by an inspection agency operating with the customer point of view. Samples are selected at random from completed product, commonly as it moves on its way to be packed for shipment, and comprise a relatively small proportion of the total output. The inspection results obtained from these samples will permit conclusions with respect to the quality of the general output but not ordinarily with respect to the quality of individual lots.

While the plan does not provide lot-by-lot protection, it does have safeguards in the form of two controls:

- nonconformance criteria applicable to the inspection results for individual samples taken during the course of the month, and
- a quality control chart rating plan applicable to the cumulative results for the entire month.

In addition, quality surveys, as described by Mr. Paterson[1], provide a continuing check of the manufacturer's methods and control procedures. This over-all plan, a result of cooperative development by Bell Laboratories and the Western Electric Company, has been in operation with only minor modifications for many years.

Classes of Product—Sample Sizes

The balance of this article outlines the basic features of the check inspection plan as it is applied to products that we refer to as "apparatus", such as relays, transmitters, and electron tubes (see Table II), many of which are, in general, used as components of more comprehensive assemblies. The same plan with specific modifications is applied to switchboards and wired equipment products which are in the nature of assemblies of apparatus and circuitry for use in local and toll central offices.

TABLE II—Partial List of General and Specific Classes of Apparatus

Amplifiers	Lamps
Capacitors	Line Hardware
Mica	Meters
Paper	Networks
•	•
•	•
•	Plugs
Coils	Coaxial
Balancing	•
Choke	•
Heat	Relays
Radio Frequency	Round Type
•	Polarized
•	•
Coin Collectors	•
•	**Resistors**
•	Telephone Sets
Dials	Thermistors
Diodes, Junction	Thermocouples
Equalizers	Transistors
•	Transmitter Units
Keys	Varistors
Central Office	•
Station	•

Apparatus products are divided into classes, each treated as a separate "population" or "universe" as we call it, for purposes of sampling inspection and reporting inspection results. The amount of inspection for any class of product depends on the quantity of output. The required amount of inspection is expressed as a monthly sample size—the larger the monthly production, the larger the monthly sample size—the sample to be distributed over the entire monthly output. The set of basic sample size curves used for this general type of inspection is shown in Fig. 1. These are empirical curves chosen after careful consideration of the varied classes of product to which they were to be applied as well as of the quantities of production to be encountered. The complete set of curves has been in use for over 15 years, some of the curves even longer, and experience with them has been generally satisfactory.

With these curves the monthly sample size varies with the square root of the monthly output so that if the output increases 4 to 1, for example, the sample size increases only 2 to 1. The top four curves apply to the classes of product that we call apparatus and are based on the following formulas:

$$\text{Curve 1, } n = 2.5\sqrt{2N}$$

$$\text{Curve 2, } n = 2\sqrt{2N}$$

$$\text{Curve 3, } n = 1.25\sqrt{2N}$$

$$\text{Curve 4, } n = \sqrt{2N}$$

where n is the monthly output, in number of units.

(The lower two curves apply to other products, including specific types of wired equipment and certain special items.) Thus, for an output of 5,000 units per month, a class of product using Curve 1 would have a monthly sample size of n = 250 units, whereas

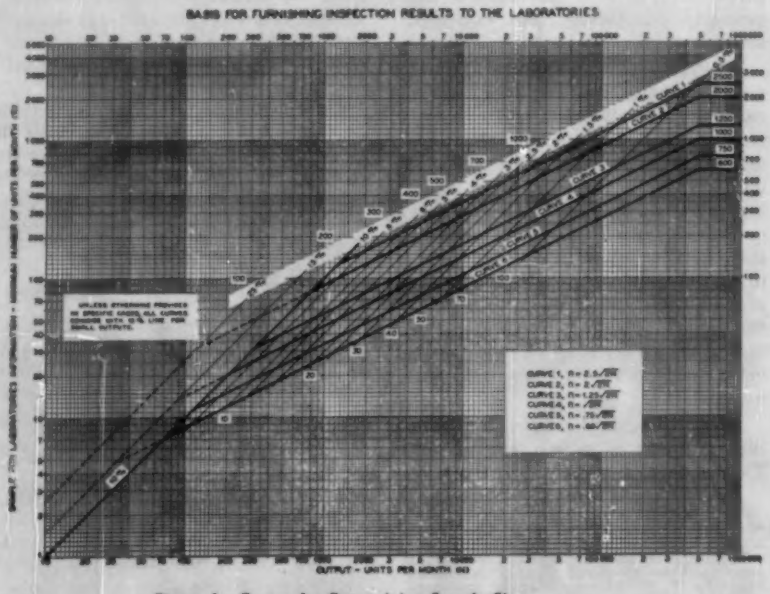

Figure 1—Curves for Determining Sample Size

a class of product using Curve 4 would have a sample size of 100 units, giving an extreme ratio of sample sizes of 2½ to 1.

The general basis for choosing one of the four curves 1, 2, 3, or 4 for a given class of apparatus product is indicated in Table III. This shows that the choice is based on a consideration of two factors: the heterogeneity of the types of design included in the class and the complexity of individual product units in the class. For example, let us consider a particular type of telephone relay. Let us call it an X-type relay which falls in a class of what we will call X, Y and Z relays. Say that these several types are of the same general construction but have different electrical requirements and different uses. Curve 3 is chosen as the sample size curve for this type of product because the universe of relays is essentially homogeneous and the relay is considered as a relatively complex unit of product. For this class of relays for an output of 10,000 units per month, the sample size per Curve 3 is 180 relays per month.

These curves give minimum sample sizes considered adequate for quality assurance purposes so long as quality is well controlled as evidenced by results of these inspections and other available information. For an important new product a sample size twice the value given by the curve is used until there is evidence that quality is well controlled at a satisfactory level.

TABLE III—Basis for Choosing Sample Size Curve—Apparatus

UNIT OF PRODUCT	UNIVERSE: HETEROGENEOUS — General Class of Apparatus, comprising a variety of types of different construction	UNIVERSE: HOMOGENEOUS — Subdivision of a General Class of Apparatus, comprising a specific type or a group of specific types of like construction
COMPLEX—relatively complex in construction; subject to variations in adjustment	CURVE 1	CURVE 3
SIMPLE—relatively simple in construction; nonadjustable or essentially stable in adjustment.	CURVE 2	CURVE 4

Selection of Sample

For any class of product, how are samples selected?

First of all, in the selection of sample units, consideration is given to their distribution in such a way as to represent fairly the entire ouput for the month. The samples are selected at the manufacturing plant from individual lots or batches as they pass the quality assurance inspection station on their way to be packed for shipment. Here it is a common situation for production quantities, batches, or lots to be a matter primarily of manufacturing convenience, that is, production lots or quantities may come in truckloads, in tote boxes, on skids or in some other form found suitable for shop purposes.

The monthly sample is thus made up of a succession of smaller samples obtained during the month, each selected at random from such a lot or truckload. Under this setup every lot is not necessarily sampled. The monthly sample is, however, distributed over the several types of product in the class, such as the X, Y, and Z types, approximately in proportion to their respective outputs.

The number of individual samples selected in the month should be such as to provide a suitable balance between two considerations:

- to avoid individual samples containing so few units as to render ineffective the application of the nonconformance criteria (to be discussed later), and
- to avoid taking so few samples as to render difficult the physical segregation of nonconforming lots.

For example, the above-mentioned monthly sample of 180 relays might be made up of 18 samples of ten relays each or 16 samples of ten and four samples of five relays each. This matter of splitting up the monthly sample into the smaller subsamples requires judgment on the part of the inspection agency—no absolute rules are given.

Character of Inspection

Under this check inspection plan each unit in the monthly sample is

- checked for conformance to engineering requirements specified for that unit, and
- inspected visually for characteristics not specifically covered by engineering requirements, including such items as workmanship, finish, appearance, general character of material and marking.

Inspection is made on an *attributes* basis. It normally includes only those characteristics that are made available to check by taking the unit apart to the extent intended by design for installation and maintenance purposes. For some products which are in effect sealed units, such as loading coils and certain types of filters and networks, it is required that some features be inspected in process before the unit is sealed. Where such inspections are not specifically required, the plan assumes that processes will be observed or that product units will be dismantled whenever there is reason to believe that the serviceability or life of the product is affected by conditions not observable without dismantling.

Any departure from engineering requirements or from accepted standards of good workmanship is considered as a defect.

Classification of Defects

The check inspection procedure under discussion covers products of a wide range of complexity. Experience has indicated that for the more complex products, at least, the simpler statistics, like p (fraction defective) or u (defects-per-unit) are not sufficiently refined for use as measures of quality. They fail to take into account two important things:

- defects of different kinds are not equally serious, and
- defects of the same kind differ in seriousness according to the extent of departure from specified limits or standards.

We therefore use a measure of quality, called "demerits-per-unit," in which defects are classified and given weights in accordance with their seriousness.[5]

A standard four-fold seriousness classification of defects—Class A, B, C, and D with demerit weights of 100, 50, 10, and 1—has been adopted, together with the following set of

standard definitions that serve as a guide for classifying defects.

Class A—Very Serious (Demerit Value, 100)

(a) Will surely cause an operating failure of the unit in service which cannot be readily corrected in the field, e.g., open relay winding; or

(b) Will surely cause intermittent operating trouble, difficult to locate in the field, e.g., loose connection; or

(c) Will render unit totally unfit for service, e.g., dial finger wheel does not return to normal after operation; or

(d) Liable to cause personal injury or property damage under normal conditions of use, e.g., exposed part has sharp edges.

Class B—Serious (Demerit Value, 50)

(a) Will probably cause an operating failure of the unit in service which cannot be readily corrected in the field, e.g., protective finish missing from coaxial plug; or

(b) Will surely cause an operating failure of the unit in service which can be readily corrected in the field, e.g., relay contact does not make; or

(c) Will surely cause trouble of a nature less serious than an operating failure, such as substandard performance, e.g., protector block does not operate at specified voltage; or

(d) Will surely involve increased maintenance or decreased life, e.g., single contact disc missing.

(e) Will cause a major increase in installation effort by the customer, e.g., mounting holes in wrong location; or

(f) Defects of appearance or finish that are extreme in intensity, e.g., finish does not match finish on other parts—requires refinishing.

Class C—Moderately Serious (Demerit Value, 10)

(a) May possibly cause an operating failure of the unit in service, e.g., contact follow less than minimum; or

(b) Likely to cause trouble of a nature less serious than an operating failure, such as substandard performance, e.g., ringer does not operate within specified limits; or

(c) Likely to involve increased maintenance or decreased life, e.g., dirty contact; or

(d) Will cause a minor increase in installation effort by the customer, e.g., mounting bracket distorted; or

(e) Major defects of appearance, finish or workmanship, e.g., finish conspicuously scratched, designation omitted or illegible.

Class D—Not Serious (Demerit Value, 1)

(a) Will not affect operation, maintenance or life of the unit in service (including minor deviations from engineering requirements), e.g., sleeving too short; or

(b) Minor defects of appearance, finish or workmanship, e.g., slightly scratched finish.

Table IV gives the basic content of these definitions.

In the course of inspection every defect found in a sample is classified under one of these headings (A, B, C, or D). A consistent procedure is needed in this business of classifying defects and in order to obtain uniformity from plant to plant, from product to product, from inspector to inspector, and from day to day there is provided for each class of product a so-called Demerit List.

Table V shows a portion of the Demerit List applicable to one type of relays. This is a two-page document which supplements a five-page general demerit list applicable to all relays.

Nonconformance Criteria

Let us consider the nonconformance criteria used with the check inspection plan.

As has been indicated, these check inspections with their relatively small individual samples, such as a sample of ten for a daily output of 500, cannot give the same protection as lot-by-lot inspections. But the nonconformance criteria that are provided do serve the purpose of indicating when larger samples are needed and whether batches or portions of the general output should be classified as nonconforming and treated as such. In effect, these criteria may be considered to be of the nature of one way streets. Meeting them is a necessary but not a sufficient condition for assurance that quality is satisfactory—meeting them merely means that the sample has shown no evidence of unsatisfactoriness. But a failure to meet any one of them can be taken as a definite indication that the collective product represented by the sample is nonconforming to a suitable standard of quality.

The nonconformance criteria are stated values of the maximum number of defects of a given kind, depending on its seriousness (Class A, B, C, or D), that can be permitted in a sample of a given size, n. These criteria are given in Table VI. They apply to each individual sample taken during the course of the month and to each individual kind of defect separately. Statistically they are 3-sigma limits of sampling variation based on levels of ¼ percent, ½ percent, 2 percent and 4 percent defective respectively for Class A, B, C, or D defects. They were chosen empirically for application to the particular circumstances contemplated by the check inspection plan, using relatively small individual samples, often not more than five or ten units, rarely as high as 50 units, and using the particular seriousness definitions and demerit weights selected for the four classes of defects, and have served satisfactorily for application to the wide variety of products encountered in telephone work.

If the number of defects of a given kind observed in a sample exceeds the nonconformance criterion for the

TABLE IV—Basic Definitions—Classification of Defects

Defect Class	Demerit Weight	Cause Pers. Injury	Cause Operating Failure	Cause Intermit. Op. Trouble Difficult to Locate in Field	Cause Subst'd Performance	Involve Incr'd Maint'ce or Decr'd Life	Cause Increase in Instal. Effort by Customer	Appear'ce, Finish or Work'ship Defects
A	100	Liable to	Will Surely*	Will Surely	—	—	—	—
B	50	—	Will Surely** Will Probably	—	Will Surely	Will Surely	Major Increase	—
C	10	—	May Possibly	—	Likely to	Likely to	Minor Increase	Major
D	1	—	Will not	—	Will not	Will not	—	Minor

*Not readily corrected in the Field.
**Readily corrected in the Field.

TABLE V—Portion of a Typical Demerit List

Demerit List—U & UA Type Relays

Item	Dem.	Defect Description
		1. ELECTRICAL
		Failed on current flow test
107B	50	(See Note 8)
107C	10	(See Note 9)
108B	50	Failed on pulse repeating test
		(For general electrical defect descriptions, see Section 61, Items 101 to 106 inclusive.)
		2. MECHANICAL
201C	10	Clearance between insulated metal parts insufficient
202C	10	Relay loosely mounted (See Note 3)
203C	10	Clearance between springs and (adjacent apparatus) less than minimum (See Note 3)
204C	10	Spring touches cover or magnetic shield (See Note 3)
205C	10	Cover or Cover Cap loose (See Note 3)
206C	10	Cover spring does not bear on spoolhead
207C	10	Cover guide does not bear on core
		Contact alignment not within specified limits:
208B	50	(both pair)
208C	10	(one pair)
		•
		•
		•
		•
215C	10	thickness incorrect
216C	10	Armature legs do not bear against hinge bracket as specified
217C	10	Armature travel not within specified limits
218C	10	Contact spring tension not within specified limits
219C	10	Spring tension in wrong direction
220C	10	Equality of combined upper spring tension and combined lower spring tension (Relays with Pin Type Hinge Only)
221C	10	Buffer spring tension not within specified limits
222C	10	Buffer spring position not within specified limits; no stud gap
223C	10	Armature back tension less than minimum
224C	10	Stud rubs on springs through which it passes
225C	10	Springs bent; deformed; (damaged)
226C	10	Clearance between springs insufficient
227C	10	Air gap between stud and spring not as specified
		Contacts:
228B	50	do not make (neither pair make)
		•
		•
		•
		•

defect in question, an additional sample, at least twice as large as the original sample, is taken and inspected for that defect to see whether the first sample indication of nonconformance might be removed by more complete information. If the number of defects observed in the two samples combined exceeds the nonconformance criterion for that sample size, one of two actions must be taken:

- reject the lot or batch represented by the samples; or
- accept the lot as nonconforming, such action to be subject to decision by the Quality Assurance Department.

In addition, inspection of prior and subsequent product is required to the degree necessary to clear up the trouble if it extends beyond the current lot.

The following example illustrates the use of the nonconformance criteria in the check inspection plan. Suppose in a sample of ten relays the inspector finds one Class B defect, say a failure to meet the 500-volt breakdown test. Looking at Table VI for Class B defects and a sample size of $n = 10$, he finds that 0 defects are allowed. Hence, based on this information alone, the lot of relays represented by the sample is considered non-conforming.

However, in this procedure the inspector is permitted to take a second sample at least twice as large as the first sample, that is, 20 additional units in this case, and inspect them for the same kind of defect found in the first sample (500-volt breakdown). The total results are then compared with the appropriate criterion in the nonconformance table for the cumulative sample size.

Suppose no additional breakdown defects were found in the sample of 20 so that he had a total of only one defect in the cumulative sample of 30. Referring to the table, he sees that one Class B defect is permitted in $n = 30$. Under the procedure, this result is considered as removing the first sample indication of nonconformance—that is, the lot is no longer considered nonconforming and no action is required.

On the other hand, suppose the second sample of 20 disclosed a second 500-volt breakdown defect, giving a total of two such defects in the cumulative sample of 30. Since the table shows that only one Class B defect is permitted in $n = 30$, the lot is considered nonconforming.

The normal procedure for a nonconformance condition with respect to defects having a significant effect on the serviceability of the product calls for rejection of the lot, returning it to the manufacturer for reinspection and repair. Furthermore, since the small samples are not being drawn from every truckload or production lot, it is required that the inspector sample immediately preceding unsampled lots as well as all immediately succeeding lots, carrying his inspection sufficiently far fore and aft until it is evident that the product has been cleared of the difficulty in question. In some cases it is necessary to open up packaged product in unshipped stock.

However, provisions are made for accepting product as non-conforming when the nonconformance is judged to be of minor importance. Such action is usually taken, for example, if the defects in question:

- are not of a continuing nature,
- do not affect large quantities of product, or product whose value is of major consideration, and
- represent minor departures from engineering requirements or from generally accepted standards of good workmanship which would not
  - interfere with operation,
  - cause service reaction, or
  - noticeably increase maintenance or replacement costs.

The nonconformance levels and criteria are set on the basis that if products are maintained at acceptable quality levels, the chances of the criteria being exceeded are very remote. On the other hand, when the criteria are exceeded, this is taken as an indication of the need for more

TABLE VI—Nonconformance Criteria for an Individual Inspection Item

No. of Units in Sample, n	Max. No. of Defects in Sample			
	Class A	Class B	Class C	Class D
1-2	0	0	0	0
3-4	0	0	0	1
5-8	0	0	1	1
9-16	0	0	1	2
17-18	0	0	2	3
19-25	0	1	2	3
26-31	0	1	2	4
32-36	0	1	3	4
37-48	1	1	3	5
49-50	1	1	3	6
51-65	1	1	4	6
66-75	1	2	5	7
76-90	1	2	5	8
91-100	1	2	6	9
Over 100	**	**	**	**

**Class A $= 0.0025n + .150\sqrt{n}$.
Class B $= 0.0050n + .212\sqrt{n}$.
Class C $= 0.0200n + .424\sqrt{n}$.
Class D $= 0.0400n + .600\sqrt{n}$.

information or for taking corrective action with respect to the product currently being furnished.

Demerit Rating of Quality

So much for the first of the two safeguards used in this check inspection type of procedure—the nonconformance criteria that are applied to each quality characteristic separately and to each small sample taken during the course of the month. These criteria protect against serious departures from desired quality for individual features and invoke rejection and stoppage of delivery where necessary.

The second safeguard used is a quality control chart rating plan which is applicable to the cumulative results for the entire month for each class of product. This provides a demerit rating of quality which has somewhat stringent requirements on over-all quality considering all quality characteristics collectively.

As mentioned before, each defect found in a sample during the course of a month, whether it is a failure to meet a specified requirement or a failure to meet some accepted standard of good workmanship is classified as A, B, C, or D and assigned a number of demerits, 100, 50, 10, or 1, according to its seriousness classification as given in the demerit list for the product.

For any class of product, the number of demerits for the month

$$D = w_A d_A + w_B d_B + w_C d_C + w_D d_D,$$

$$= 100 d_A + 50 d_B + 10 d_C + 1 d_D,$$

where d_A, d_B, d_C, and d_D are the number of Class A, Class B, Class C, and Class D defects, respectively, found in the sample.

The value of demerits-per-unit,

$$U = \frac{D}{n},$$

where n = sample size for the month.

To avoid bias, only first sample inspection results are used in computing the demerit rate. When additional samples have been inspected because of indications of nonconformance, neither the number of defects found nor the number of units inspected is included in the demerit rate for the month.

Figure 2 gives an example of the computation of demerits-per-unit. The control chart for demerits-per-unit, at the bottom of Fig. 2, indicates quality month by month relative to

X, Y AND Z TYPE RELAYS – UNMOUNTED
MONTHLY DEMERIT RATE

TYPE OF DEFECT	DEMERIT WEIGHT	NO. DEFECTS JUNE	NO. DEFECTS J-A	NO. DEFECTS SEPT.	NO. DEMERITS JUNE	NO. DEMERITS J-A	NO. DEMERITS SEPT.
A	100	0	1	0	0	100	0
B	50	0	2	0	0	100	0
C	10	5	10	6	50	100	60
D	1	1	4	3	1	4	3
		TOTAL DEMERITS —			51	304	63
		SAMPLE SIZE, n —			232	240	165
DEMERITS PER UNIT = DEMERITS / NO. RELAYS IN SAMPLE					.22	1.27	.38

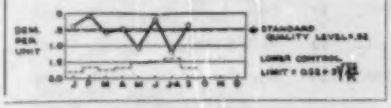

Figure 2—Typical Summary of Inspection Results and Control Chart

the standard quality level which is 0.52 demerits-per-unit. A lower control limit is shown on the chart; the upper control limit, in this case, is zero.

This is an example of a chart used for obtaining "control with respect to a given standard". In order to construct a demerits-per-unit control chart of this type it is necessary to establish two standard values, one a standard value of demerits-per-unit and the other a standard variance factor, indicating the normal expected sampling variation dependent on the expected relative proportions of Class A, B, C, and D defects.

These quality standards represent engineering estimates of what quality at delivery should be, taking into consideration the economic balance between the needs of service and the costs of production. Assuming a standard that is in fact economic, then:

- if the quality rate is consistently above standard, the situation should be explored to make sure the product is not costing more than it is worth, whereas
- if the quality rate runs consistently below standard, this indicates that quality is not good enough—increased costs due to troubles in the telephone plant are greater than the first cost of obtaining better quality.

The setting of such standards involves the use of all information that we have at hand, both quantitative and qualitative. Past inspection results are reviewed. Consideration is given to a system of maximum allowances for individual features. Performance records in the telephone plant are considered.

An example of some of the constituents of demerits-per-unit quality standards is shown in Fig. 3. The allowance, in defects-per-unit, for each class of defect for X, Y and Z type relays is given, as well as the computation of the standard values, U_s and C_s. The standard quality level,

$$U_s = 100u_A + 50u_B + 10u_C + 1u_D,$$

where u_A, u_B, u_C, and u_D are the defects-per-unit values for Class A, Class B, Class C, and Class D defects respectively.

The computed value, rounded to two significant figures, is 0.52 demerits-per-unit, which is the standard quality level shown in Fig. 2. The value of the standard variance factor,

$$C_s = (100)^2 u_A + (50)^2 u_B + (10)^2 u_C + (1)^2 u_D,$$

is 25, when rounded. The equation for the control limits for a demerits-per-unit chart is

$$U_s \pm 3\sigma_U,$$

where $\sigma_U = \sqrt{\frac{C_s}{n}}$,

and n = sample size for the month.

For the X, Y and Z type relays, the control limits are

$$0.52 \pm 3\sqrt{\frac{25}{n}}.$$

A demerits-per-unit quality rate is appropriate for a class of product when a single pair of quality standards is applicable to all types of product included in the class. An alternative quality rate is the demerit index,

$$I = \frac{D}{nU_s} \text{ or } \frac{U}{U_s}.$$

Since the demerit index is the ratio of observed demerits to expected demerits, the standard quality level is always 1. Control limits are

$$1 \pm 3\sigma_I,$$

where $\sigma_I = \frac{\sqrt{nC_s}}{nU_s}$ or $\frac{\sigma_U}{U_s}$.

X, Y AND Z TYPE RELAYS – UNMOUNTED
QUALITY STANDARDS

DEFECTS CLASS	DEMERITS PER DEFECT w_x	CONTRIBUTIONS TO STANDARDS: DEFECTS PER UNIT u_x	DEMERITS PER UNIT	(DEMERITS)² PER UNIT
A	100	.0014	.140	14.00
B	50	.0034	.170	8.50
C	10	.0205	.205	2.05
D	1	.0097	.010	.01
		TOTAL	.525	24.56
		STANDARDS:	$U_s = 0.52$	$C_s = 25$

$U_s = w_A u_A + w_B u_B + w_C u_C + w_D u_D$, AND
$C_s = w_A^2 u_A + w_B^2 u_B + w_C^2 u_C + w_D^2 u_D$
ROUNDED TO TWO SIGNIFICANT FIGURES.

Figure 3—Computation of Quality Standard U_s and C_s

A demerit index chart for the X, Y, and Z type relays would look just like the demerits-per-unit chart in Fig. 2 except for a change in scale. The scale would be just about doubled, since $U_s = 0.52$.

Some classes of product comprise types which differ so much that different pairs of standard values are needed to represent the different types in the class. For those classes a demerits-per-unit quality rate cannot be used, a demerit index is needed.

When the types of products included in one class have different standard values, the demerit index for the class is a weighted average of the indexes for the several types. The general equation, for an over-all demerit index is

$$(1) \ldots\ldots I_O = \frac{\Sigma W_i I_i}{\Sigma W_i},$$

where W_i = weight for the i^{th} type,
I_i = index for the i^{th} type, and
Σ = sum over all types.

$$\sigma_{I_O} = \frac{1}{\Sigma W_i}\sqrt{\Sigma\left(\frac{W_i^2 C_{s_i}}{n_i (U_{s_i})^2}\right)}$$

where C_{s_i} = standard variance factor for the i^{th} type,
U_{s_i} = standard quality level for the i^{th} type, and
n_i = monthly sample size for the i^{th} type.

The 3-sigma control limits are

$$1 \pm 3\sigma_{I_O}$$

The equations for I_O and σ_{I_O} can be simplified if the "demerit expectancy" values, $n_i U_{s_i}$, which vary approximately with the relative complexity of the products, are used as weights. In that case the over-all demerit index,

$$(2) \ldots\ldots I_O = \frac{\Sigma D_i}{\Sigma n_i U_{s_i}},$$

where D_i = total number of demerits for the i^{th} type.

The 3-sigma control limits are

$$1 \pm 3\sigma_{I_O},$$

where $\sigma_{I_O} = \dfrac{\sqrt{\Sigma n_i C_{s_i}}}{\Sigma n_i U_{s_i}}$.

The simplified equation (2) is generally used for combining indexes for several types into an over-all index for a class of product. The general equation (1) is useful for combining indexes for several classes of product into an over-all index for a general classification of product, since other weights, for example, monetary weights, may be used.

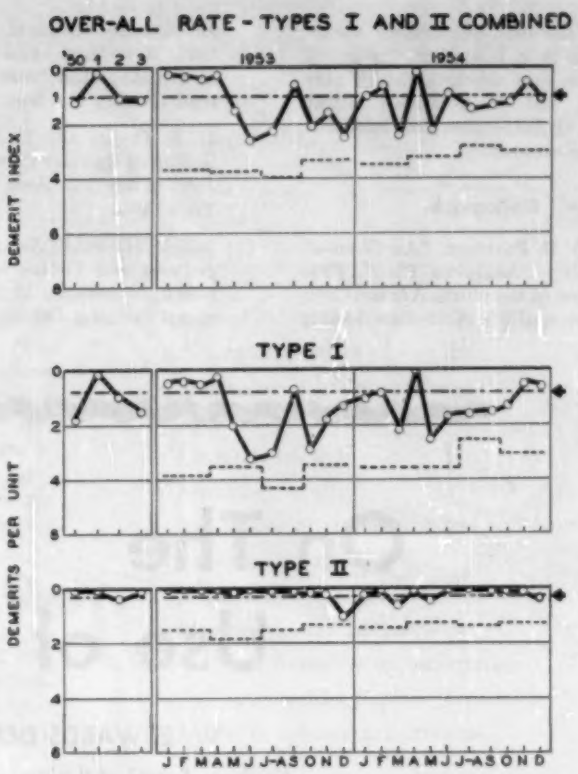

Figure 4—Showing Use of a Demerit Index as an Over-all Rate, Combining the Separate Rates of Two Components

Figure 4 shows an example of the use of a demerit index. The second and third charts are demerits-per-unit charts for two types of station product which are included in one class. The standard values for Type I (both U_s and C_s) are larger than those for Type II, since Type I is relatively more complex than Type II. The first chart is a demerit index chart for the two types combined. The demerit index values represent the demerit rate for the class.

Whether the demerit rate for a class of product is in terms of demerits-per-unit or demerit index, a point falling below the lower control limit gives the basis for stating, in the Quarterly Quality Report, that the class of product is "significantly below standard" for the month. This condition also serves as a basis for corrective action on the process for the particular type, or types, which contributed significantly to the below-standard rate.

We recognize that a single numerical rating cannot tell the whole story about quality, but usually, for any class of product, quality is satisfactory if

- there are no nonconformances, or practically none, for individual characteristics, and
- the quality rate is within control limits.

When This Plan May Be Used

The check inspection and demerit rating plan described in this article is considered applicable primarily

- when it is used as a part of an over-all quality assurance plan[1], and
- when inspection is performed on the manufacturer's premises by an inspection agency operating with the customer point of view.

The plan was developed for use under circumstances where the customer has prior knowledge that the manufacturer's processes are normally well controlled and that the product has undergone adequate prior inspections before being submitted to the inspection agency. Contributory information on these matters is obtained through quality surveys, which are an important part of the over-all quality assurance plan. Another important part of the over-all plan is the analysis of complaint information which serves as an added check on the specification, production and inspection processes.

When the over-all quality assurance plan is in operation, the check inspection and demerit rating plan requires but a relatively small amount of inspection for adequate quality assurance.

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On The Use of Theory

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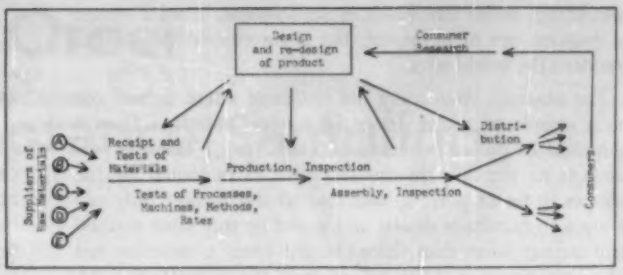
MY THEME tonight is the source of power of statistical theory, how to use it in industry and in research, and more especially, how not to misuse it. In this day, when so many decisions of business and management, technical and legal, depend on the results of samples and experiments, it is important to be sure of what the results mean, and what they do not mean. To this end, I propose to study tonight the power and the limitations of statistical theory; also the power and the limitations of substantive knowledge, in order to try to understand the different kinds and degrees of knowledge.

The use of statistical theory, because it offers economy, speed, and security not attainable otherwise, has become an indispensable aid to procurement, to production, to processes and methods, and in marketing and consumer research. Without a theory, any prediction, and any decision based thereon, is risky. The day has past when "theoretical" means impractical. There was a time, not so long ago, when jobs open for men with knowledge of statistical theory placed emphasis on experience in a particular business or industry. The question today is only whether the man knows enough theory, and whether he understands what he knows.

I once defined the statistical control of quality as THE APPLICATION OF STATISTICAL PRINCIPLES AND TECHNIQUES IN ALL STAGES OF PRODUCTION DIRECTED TOWARD THE ECONOMIC MANUFACTURE OF A PRODUCT THAT IS USEFUL AND HAS A MARKET. This definition stretches from the procurement of raw materials on one end of the line, to the consumer at the other end, as the accompanying diagram indicates. I need not elaborate here on the importance of the consumer and of consumer research, nor why it is important that the management of a manufacturing concern be so organized that the results of consumer research have a clear channel to feed back into the design of the product, which is of course, incidentally, the design of future product. Price without a measure of quality has no meaning, and quality has no meaning except in terms of the consumer's demands.

The 1955 Shewhart Medalist
W. Edwards Deming



The production line, from raw material to the consumer. Statistical techniques are indispensable in one form or another at every point in the entire production line. At every stage in the production line, and in the consumer research as well, statistical information should feed back in a continual stream for re-design of the product to relieve problems of production and to meet changing demands in respect to quality, uniformity, and quantity.

Between the procurement of raw materials on one end of the production line, and the consumer on the other end, lie the problems of design, of production, of specifications and of standards, both for product made and for product purchased; problems of the selection and training of people, problems of accounting and auditing, of distribution, of inventory. There are the basic value-judgments in the management of a business enterprise, and the perception of the social, political, and economic problems that a business encounters in the achievement of these aims.

The first selection of problems is the responsibility of management, delegated perhaps to expert knowledge of specific subject-matter such as chemistry, engineering, economics, marketing, medicine. The screening of problems, to decide which ones have any possible solution, and their formalization for the use of decision-theory, is largely statistical. Once formulated, the statistical portion of a problem is dependent purely on statistical theory. Statistical problems are not solved by chemistry, administration, engineering, medicine, nor by anything but statistical theory.

Two features about theory are impressive: first, the multivaried form of application of statistical techniques in the solution of the host of problems that stretch from raw material to consumer; second, the universal form of the basic statistical theory and principles for all these problems.

Statistical theory is based on probability. Decision-theory is based on the concept of achieving, in the long run—i. e., on a probability model—the minimum economic loss from the possible errors in decision. The manifestations of statistical theory take the form of theorems on variance, tests of significance, tests of hypotheses, the Shewhart charts, nonparametric methods, order statistics, and other specific techniques. The symbols in statistical theory care not whether they will be used to design and interpret a sample of human populations or a sample of physical material. They care not whether they will be used to design a test of consumers' reactions to products, or to test concentrations of materials, different levels of heat, and different levels of pressure, in the manufacture of a pharmaceutical product. In fact, the symbols don't care whether we use them at all. Like any real theory, statistical theory is knowledge a priori, independent of experience. Like a theorem in plane geometry, which would remain true even though we were two-dimensional beings on a sphere, and had never thought of a plane, statistical theory remains smugly true whether we learn how to use it or not, or even whether we try.

It is interesting to take a look at the impact of statistical theory during the past 20 years. The fact is that statistical theory has changed practice in almost everything that man does. We need only turn back the clock and look at what has happened to:

Production; quality, uniformity, output

Testing of materials

The science of inventory levels

Appraisal of inventory

Consumer research

Marketing

The science of maintenance and replacement

Government statistics

Accounting and auditing

Management and administration

Current information for management

Studies in sociology and in population

Studies in opinions and attitudes.

I have omitted agricultural science and medical research because use of statistical methods commenced many years earlier in those sciences.

It is noteworthy that the new practices were generated, NOT from expert knowledge of engineering, chemistry, production, accounting, population, census methods, agriculture, marketing, but from statistical theory. Much of the impact has been brought about by very simple statistical theory. Surely, any theory that possesses the power to change practice in so many activities of man calls forth extreme respect.

Every year, while all these drastic changes have been taking place, plant managers and experts in production would certainly have declared that they have squeezed the last ounce of efficiency from their methods; that everything possible is being done to improve quality and uniformity and to satisfy the consumer, that there remained no possible further savings of materials, manpower, or machines. Yet look what has happened to uniformity, to output, to quality.

You will get the same answer today. Improvements are nevertheless visible month by month. For example, traditional procedures in auditing, operation, and management, used by nearly all industries today will gradually be displaced during the next few years by the speedier and more reliable results of sampling.

One may under the proper conditions place absolute faith in a statistical calculation, but it is important to know what these conditions are and what the calculations mean. If the requirement of randomness is met in an experiment or in a survey, then a calculated producer's risk, a test of significance, or a standard error, has the standing and dignity of a mathematical theorem. The interpretation of a statistical

calculation, under conditions or randomness, is not a matter of opinion nor of judgment, but is incontrovertible and is standard the world over.

For example, concerning the results of a test, carried out on a sample of pieces drawn by random numbers from a shipment of pieces, one may calculate (e. g.) that the percentage of impurity in the shipment is estimated by the sample to be 24 percent, and that on the average only one sample in hundreds drawn and tested by this same method will depart more than three percent from a complete test of all the pieces in the shipment, were the complete test carried out with the same care, with the same instruments, and with the same definitions as were expended on the samples. This is a pretty important statement, of far-reaching consequences.

A statistical calculation of this kind, however valid and useful it be for the material that had a non-zero probability of selection for the sample, does not apply objectively to other material that had no chance to be in the sample. This other material may nevertheless be of importance.

A physician who carries out an experiment on a treatment with different concentrations of a drug may select by random numbers patients in a hospital and give to each one at random a concentration of 0, 25, 50, or 100. Statistical calculations such as the t-test refer only to the patients that had a chance to be in this experiment. The generalization from these patients to other people that suffer from the same disease, or to all people, is not statistical theory at all, but is subject-matter—in this case, medicine. Someone must make the generalization, or refuse to make it, on the basis of judgment. This is not a job for statistical theory.

Statistical theory can, however, furnish methods by which to test samples of other lists of patients, from different hospitals, or from different forms of the disease, or at different times of the year, and can furnish tests by which one may judge whether the different lists of patients are significantly different from one another. These statistical calculations are of extreme importance as aids to the substantive expert when he must decide whether to generalize to other material, or to the process or to the cause-system.

Statistical theory can not generate a hypothesis to test; yet statistical theory is essential in the design and in the interpretation of the test of a hypothesis that the substantive expert formulates for his work. Statistical theory can not decide which quality-characteristic to measure, nor whether any quality-characteristic at all should be measured. Statistical theory can not decide which material to test, nor whether any material should be tested. Statistical theory can not think of a new product. Statistical theory can not decide which products to compare in a test of consumer reactions. Statistical theory can not decide whether temperature, concentration, or rate of flow are important variables to study in an experiment to discover the optimum operating conditions for the production of a chemical compound. Statistical theory can not put questions into questionnaires in a study of consumer attitudes and demands.

It is the expert in the subject-matter who must choose which quality-characteristic to measure, which material to test, what new products are needed, which products to compare, which components of the process to test, which conditions of environment to test, and to declare IN ADVANCE how he will generalize from the material subject to test, to material not subject to test.

It is a fact, though, that one can not design a new product, nor test it, nor compare two or more products, without the aid of statistical theory. Without theory, the development and tests are unreliable and too costly.

Statistical techniques show us how to discover reliably and economically the difference between a selected quality-characteristic for one material, and the same quality-characteristic for another material, or the difference between two methods of manufacture or of treatment. In fact, without the statistical theory of design, there is no reliable or economic approach to the problem of significant differences nor to the discovery of optimum operating conditions.

Statistical techniques, in their ability to aid the discovery of causes, are creating a science of management and a science of administration. Statistical techniques have the ability to separate out the responsibilities for action into different levels of administration. A point out of bounds, a significant difference in rates of production, or a significant difference between the proportions defective from two suppliers, or between the accident-rates in two areas, a significant trend or a run, all point to the existence of a SPECIAL CAUSE of variation NOT COMMON to all the lots or to all the areas involved.

The discovery of a special cause of variation, and its removal, are usually the responsibility of someone who is connected directly with some operation. It is his job to find the cause, and to remove it. In the case of accident rates, a significant difference indicates the existence of causes specific to a certain area.

In contrast, there are COMMON CAUSES of defectives, of errors, of low rates of production, of low sales, of accidents. The discovery and the correction of common causes is usually the responsibility of someone higher up. The common causes may be poor light, poor or variable raw material, obsolete equipment, humidity, inadequate instruction, poor supervision, or plain lack of a quality-program. Poor sales may stem from a faulty product. The worker at a machine can do nothing about causes common to all machines. He is responsible only for the special causes chargeable to him. He can not do anything about the light; he does not purchase raw materials; the training, supervision, and the company's policies are not his.

The common causes are the most difficult to discover. The removal of a common cause is not always feasible: the gain in production or in uniformity may not be worthwhile. The decision belongs to management.

A usual mistake in administration is to attribute any difference to a special cause (to a machine, to a worker, to a specific area) when no special cause exists, and when the real causes of the defectives, errors, low sales, and accidents, are common to all the product, or to all the areas. This mistake is an easy way out, as it points the finger at some person or at some special condition or circumstance and gives the appearance of action. It is costly action, however, as it is misdirected and its effect is exactly opposite to what is desired. It actually raises the frequency of defectives, and creates more errors and accidents, and will eventually demoralize a force of workers.

Success in administration depends heavily on a judicious choice of problems and clever separation of the responsibilities for solving them. Statistical techniques provide an indispensable aid to administration, as they perform this separation with reliability that is impossible otherwise. We are at the dawn of a real science of administration and management.

Mail Order Acceptance Sampling

FRED STREIT

*Popular Merchandise Co., Inc.**

Introduction

A loss ratio of ten items for each defective passed in a manufacturing operation could be catastrophic. And yet, in a mail order club plan, where ten women purchase through one woman, the receipt of one defective item by a member can destroy future sales for the other ten.

This ratio of ten to one, and an estimated loss of one to two million dollars yearly in receipt of defective merchandise from vendors, led to the establishment of a merchandise quality control program at one of the largest club plans in the United States.

Records indicated that incoming merchandise contained between three and four percent defectives. Records also indicated that customers had returned only 1 to 1½ percent, revealing that they had been electing to keep defective merchandise and possibly not purchase again.

Seeing defective merchandise, particularly clothing in a department store, has little effect on the consumer. If a woman finds a bad garment on the rack in the store, she can readily pass it over and select a good item. However, in a mail order transaction, the woman can only select the item, color, size, etc., but not the piece she will receive. She is placing her faith in the company that the garment she receives is in perfect condition. A money-back guarantee helps to assure her of satisfaction.

Top management believed that the company was being used as a dumping ground by its sources. This was borne out when a vendor confided to the writer, "I'll admit I was careless in your merchandise. I knew you weren't checking."

Program

Initially, the major problem was the acceptance control of the clothing and fashions series. Since the program involved the creation of a new department, organizational lines had to be established.

To maintain the separation of purchasing and examination, quality control was established as part of the industrial engineering program. Quality control was to act in an advisory capacity to the buyers and to the stock department. Departmental lines were to be crossed, if necessary, in almost every case involving clearly defined lines of responsibility.

As its basis, the program has six major aims:

1. To establish quality standards
2. To appraise conformance to these standards
3. To establish courses of action when standards are not met
4. To plan for improvements in standards
5. To provide new product quality information
6. To provide quality information on current stock

Establish Quality Standards

Standards of the type necessary for the examination desired were not available. As a result, "common sense" standards had to be employed. Such a standard is shown by the card illustrated in Fig 1.

EXAMINATION SECTION

Master Control Card

DESCR Jacket, Boys Red, Green, Brown — CATALOG NO. 03178

Sizes 4, 6, 8, 10, 12 — MANUFACTURER Jones

INSPECT FOR:	WEIGHT	PIECES CHECKED	PERMITTED DEFECTIVES
1. Cleanliness	.5	10	.5
2. Buttons: Complete set, sewn on tightly	.5	22	1.5
3. Finishing: No open seams, no ragged edges	1	25	1.5
4. Colors: Match with swatches	1	40	2.5
5. Sizes: Test one of each size on available dummy forms	1	50	3.0

BUYER: Smith

ACTION: WHEN TOTAL DEFECTIVES ON MOC 101 EXCEEDS THE PERMITTED DEFECTIVES FOR THE PIECES CHECKED NOTIFY MERCHANDISE QUALITY CONTROL SUPERVISOR

Figure 1

According to a home economist, textile technician, or other highly skilled person in the field of clothing and fashions, these standards are deficient. However, for the initial purpose intended, the standards had to suffice.

The examination personnel were neither technicians nor highly skilled. However, it was decided that the women employed to do the examining had to fill certain basic requirements:

a. Married

A married woman has had experience in purchasing all types of items for her household. Presumably, she has some understanding of dollar value and what can be expected for a given price.

b. Over 30 years of age

As a requirement, this would tend to give maturity to the program.

c. High school education or equivalent

d. Not color blind

Shading of a garment is an important element.

The standards were designed as a guide to the examiner. No standard written on one card could completely describe every element that could be defective. A large part of the examination procedure was left to the buying intelligence of the examiner. The examiner's job description is as shown in Table I.

Appraise Conformance to These Standards

In conjunction with discussing the detection and elimination of defec-

*Mr. Streit is now with Peter J. Schweitzer, Inc. in Elizabeth, N. J.

tive merchandise, the work flow of merchandise will be covered.

Incoming merchandise is processed through a master receiver who verifies the delivery count of cartons and prepares the receiving ticket. From Master Receiving, the entire shipment is processed to a detail receiving section which does the following:

- Refers to the Detail Receiving Control Card MQC 104 to ascertain: (Fig. 2)
  1. Can the manufacturer's case markings be accepted as true?
  2. What is the maximum carton quantity for ease of handling?

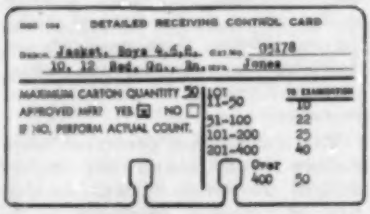


Figure 2

  3. Based upon shipment size, what is the number of pieces to be sent for examination?

- Initiates the "Inspection Record" MQC 101 filling in the following: (Fig. 3)
  1. Catalog number
  2. Manufacturer
  3. Receiving point
  4. Date
  5. Detail receiver
  6. Question section regarding the packing of the shipment.

The purpose of detail receiving in general can be outlined as:

- Make sure that we received what was ordered.
- Attempt to have the manufacturers pack the merchandise in a fashion that provides for the fastest and easiest handling at our end.

When the detail receiver has completed his phase of the operation, the "Inspection Record" is affixed to the sample and is forwarded to Merchandise Examination. The balance of the shipment is tagged "Hold" pending the outcome of the complete examination of the merchandise.

Examination

Upon receipt of the sample from detail receiving, the examiner selects the appropriate Examination Control Card (MQC 102) for the same catalog number. Prior to beginning examination she records the date of examination, the pieces checked, the buyer's name, and signs her name. Then, utilizing MQC 102, a one-word indication is entered in the "Inspected For" column of the inspection record, such as color, size, holes, flaws, etc.

TABLE I—Job Description

JOB TITLE	Examiner
ACTIVITY	Merchandise Quality Control

Objective:

The examination of samples of incoming merchandise to determine conformance to standard and to provide maximum customer satisfaction. To detect all incorrect shipments, defective merchandise, and inferior grade merchandise as regards what was purchased.

Scope:

Reports to the Merchandise Quality Control Supervisor. Responsible for measuring merchandise conformance to standards.

Responsibilities

Responsible for the proper examination of incoming merchandise.

Detects and informs the Merchandise Quality Control Supervisor of all non-conformance to standard merchandise.

Takes proper care of merchandise during examination, keeping it usable for the customer.

Opens cartons, checks contents, and re-seals cartons.

Reports all irregularities not covered in specific instructions.

Sampling

Basically, the plans are adaptations of the AOQL tables in *Sampling Inspection Tables**; however, instead of using a specific c number, it became necessary to weight each type of defect by the possibility of such a defect causing a customer to return the merchandise. For example, in most cases a soiled garment was weighted as 0.5 defects, reasoning that if a customer so desired she could clean the garment. However, holes, mis-sizes, etc., usually received a full defect. The "c" number was weighted accordingly.

A lot was considered as the total number of pieces of one catalog number arriving on a given date and received on one receiving ticket. The pieces selected had to come from at least ten different cartons within the shipment. The detail receivers were instructed to select items from the cartons on a random basis, i. e. top, bottom, right side, left side, etc. An AOQL of 1.5 percent was used in setting up the sampling plans, up to and including shipments with 500 pieces. In this case, some wishful thinking was employed. Although

*H. F. Dodge and H. G. Romig, *Sampling Inspection Tables*, John Wiley and Sons, New York 1944.

INSPECTION RECORD

Catalog # C3178 MFR: Jones

DETAILED RECEIVING

Date: FEB 25,1965
Packing Check List — Yes / No

	Yes	No
1. Are cartons marked with:		
Catalog # ?	✓	
Color ?	✓	
Size ?	✓	
Quantity ?	✓	
2. Do contents agree with carton markings?	✓	
3. Is packing slip enclosed?		✓
4. Do contents agree with packing slip?		
5. Are units marked with catalog #?	✓	
size?	✓	

Detail Receiver: EVANS
Receiving Point: FIFTH AVE.
Are cartons the same weight as on the control card? Yes ☒ No ☐
If no, what is the approximate weight? ___ lbs. ___
Was a re-pack necessary? Yes ☐ No ☒
Remarks: Time required to pack ____ hrs.

EXAMINATION SECTION

Date FEB.25,1965 Pieces Checked 25 Examiner FLORIO

Inspected for:	Tally of Defectives	No.	Weights	Total Defectives	Comments
1. CLEANLINESS	II	2	.5	1.0	
2. BUTTONS	I	1	.5	.5	
3. FINISHING		0	1	—	
4. COLOR		0	1	—	
5. SIZE		0	1	—	
			Total	1.5	

Action Taken: ACCEPTED

FOR MERCHANDISE QUALITY CONTROL USE

MQC-101

Figure 3

we knew the process average to be around four percent, we based our plans upon a process average of about 0.9 percent. The reasoning involved considered four percent as a completely unacceptable process average whereas a desired 0.9 percent would be acceptable.

Action When Standards Are Not Met

In the event defectives were encountered but not in sufficient quantity to call for rejection of the entire shipment, these pieces were deleted from the shipment, tagged defective, and held. Weekly, a compilation of the defectives was made and, under a separate procedure, returned to the vendor for replacement. This handling of individual defectives served a two-fold purpose.

- In 16 weeks, it eliminated 1200 defective pieces of merchandise from going to the mail order customers. Multiplying by the ten customers possibly affected by each defective, we can predict the possible retention of 12,000 customers.
- By returning the merchandise, however few pieces, to the vendor, he was taught that inspection was going on and that more care with his shipments would cause fewer returns and better quality ratings with our company.

The rejection of an entire shipment posed a different problem. When the nature of the defective encountered was such that it would cause serious trouble on the part of the mail order consumer, the buyer concerned was immediately contacted and disposition made. The rejection of an entire shipment was a function of:

- Stock on hand;
- Delivery time required for replacement;
- Sales demand by item.

If it was impractical to return the entire shipment to the vendor, 100 percent examination was called for with approval of the sources. Inspection charges were $3.00 per man hour. In 16 weeks, 36 hours of 100 percent examination were performed and charged to the source.

Improvement Through Vendor Education

As a further attempt at quality education for the suppliers, field trips were undertaken. Initially, a letter as shown in Fig. 4 was mailed to all sources. This letter bore fruitful results in that the troublesome sources either began corrective measures on their own or requested technical help from the company. In general, upon mailing of the letter and the inauguration of weekly trips to the sources, the defectives encountered took a sharp drop. In a period of 16 weeks $50,000 at retail prices, in defective merchandise was returned to the sources. An average of one shipment per week was 100 percent inspected or returned in its entirety to the source.

February 1, 1955

Gentlemen:

This company has embarked upon a Merchandise Quality Control Program, being interested in eliminating defective merchandise before it enters the plant. This can only be accomplished through the mutual efforts of Popular and our sources.

Among other things, the program involves the inspection of incoming shipments by a staff of trained examiners. Every shipment is examined, utilizing statistical sampling plans. In the near future, laboratory testing will also become part of the program.

If you wish, I will try to visit your plant with the intent of aiding you in your plans to prevent defective merchandise from going to us.

If there is any help my department might afford, please do not hestiate to let me know, directly or through the buyer concerned.

May I ask your cooperation?

Very truly yours,

POPULAR MERCHANDISE CO., INC.
Fred Streit
Merchandise Quality Control

FS:cs

Figure 4—Sample Letter Used In The Vendor Education Program

To cite three examples of field trip results:

- Shipments from a raincoat manufacturer supplying the company for over three years revealed a continuing 33 percent defective due to soiled garments. The soiling always occurred at the bottom of the garment. Investigation revealed that under increased volume, the source found it necessary to transport the garments between factories on racks stacked in three tiers on trucks. Apparently the truck body was not tall enough to hold three tiers and the bottom tier was dragging on the floor of the truck. The situation was remedied to the satisfaction of all concerned.
- Shipments from a blouse manufacturer revealed extremely poor garment finishing: Opened seams, holes in the cuffs, mismatched materials, etc. The manufacturer had two shipments returned and finally invited the author to visit his factory. Slovenliness was prevalent. Production was the most important element. No attention was given to controlling quality or doing any type of outgoing inspection. The manufacturer refused to partake of any sampling method or any other type of check and was subsequently dropped as a source of supply.
- Shipments from a sweater manufacturer revealed various types of defects ranging from soiled yarn to runs in the sweater. A visit to the manufacturer's plant revealed a 100 percent examination. However, the examiners, through boredom, had embarked upon a contest to see which examiner could find the fewest

TABLE II—Statistical Sampling Plan

Merchandise Quality Control
AOQL 1.5 percent

Lot Size	To Be Examined	Defectives Permitted
1-15	All	0
16-50	16	0
51-100	20	0
101-200	22	0
201-300	47	1
301-400	49	1
401-500	50	1
501-600	50	1
601-800	50	1
801-1000	85	2
1001-2000	85	2
2001-3000	125	3
3001-4000	125	3
4001-5000	165	4
5001-7000	165	4
7001-10,000	210	5

defectives. This was corrected by providing the manufacturer with a statistical sampling plan, using the same AOQL (1.5 percent) as was employed by the company. His instructions for its use and the plan can be seen in Fig. 5 and Table II.

Appraisal

The acceptance sampling program has worked. It has done what was originally established as its goal: the reduction of customer returns due to vendor cause. Formerly about two percent of total sales came back as customer returns. The current figure is below one percent and is expected to drop even further. The major obstacle to such a program was, and continues to be, the preparation of examination standards. More than any other criteria, the viewpoint of "What would the customer do if she received this merchandise?" must be the governing element, as it has been. This viewpoint provides the only basis for establishing a reputation as a quality house and thereby creating greater sales.

Instructions for Using Statistical Sampling Plan As a Double Check on Outgoing Quality

1. Continue 100 percent examination of merchandise going to Popular Merchandise.
2. Stack merchandise going to Popular separately from other goods, keeping each shipment together by itself.
3. Obtain a count of the quantity in the lot to be double checked. On the attached table, refer to the group which contains the lot size you are shipping.
4. Examine the quantity indicated in the "To Be Examined" column on the same line as the applicable lot size.
5. Select the pieces to be re-examined from every 10th or 20th box or bag, selecting from the top, middle and bottom of the stack.
6. Upon completion of the re-examination, match the number of defectives found with the "Defectives Permitted" column on the same line as the applicable lot size.
7. If the defectives found exceed the defectives permitted, the entire shipment should be re-examined, as the quality of the 100 percent examination has been poor. If the defectives found are less than those permitted, the shipment can be sent to Popular.

Figure 5—List of Instructions Sent to Vendors Along With Table II

Local Section News

". . . BUT NOT FORGOTTEN"

ALBUQUERQUE On May 7 James L. Coburn, quality control administrator of the Convair Fort Worth Division of General Dynamics Corp., addressed the section on the subject of "An integrated program to achieve high reliability in complex aircraft systems." The meeting was held in Mitchell Hall at the University of New Mexico.

An informal dinner for members and their wives preceded the meeting. The after-dinner speaker, R. W. Henderson, director of systems development, Sandia Corp., outlined the professional societies program of the New Mexico Council of Professional Societies on "Professional career counseling in the New Mexico high school system."

ALLENTOWN-BETHLEHEM The final meeting of the year was held May 18. This meeting was a combined dinner meeting with the local section of the American Society for Tool Engineers. C. W. Kennedy of the Federal Products Corp. presented an excellent talk on "Dimensional quality control."

The third training course presented by the section this year was completed May 28. At the last session 33 students received certificates for the course—"Quality control for management personnel."

BINGHAMTON On May 8 a joint meeting with the Wilkes-Barre—Scranton section was held at the Bendix Aviation Corp. Cafeteria in South Montrose, Pa. J. Sheldon gave an excellent talk on "Dispatch inspection control." A tour of the plant followed the meeting. The meeting was very successful and more plant tours are being planned for next season. After the joint meeting, the Binghamton section elected officers for the 1956-57 season.

BIRMINGHAM At the final meeting of the section for the current year, Charles L. Harris, division methods engineer, Pepperell, Mfg. Co., Pepperell, Ala., outlined quality control methods as used by Pepperell. The question period following developed into a regular textile seminar. Incidentally, fellows, anytime you see Charlie, ask him to tell you about his Texas bird dog.

BOSTON Nearly 100 members, wives, children, and guests attended the final meeting for the season at the Hood Dairy Cherry Hill Farm in Danvers. This was an open air picnic. Games, an inspection of the dairy, and a "cook out" were enthusiastically enjoyed by those attending. This is the first time Boston has attempted such an event—it is planned to feature such an outing again next year.

On May 31 members of the section were guests of Northeastern University at a panel discussion on teaching quality control which was held for the visiting group of QC teachers from Western Europe. This group, sponsored by the International Cooperation Administration, also visited several plants in the Boston area before going to the ASQC convention in Montreal.

BUFFALO The regular meeting was held on May 28 at the Hotel Westbrook and was preceded by a dinner. After the dinner, a military panel presented an informative talk on "Sampling as used by the Armed Forces." The panel was composed of J. Baron, Rochester, ordnance district representative; H. Cohmeier, Rochester, Air Force representative; K. Sours, Buffalo, Navy representative; and the panel moderator was Dr. A. Stein, research engineer of Cornell Aeronautical Laboratory.

BUZZARDS BAY Maynard S. Renner, quality control director at the Dewey and Almy Chemical Co. in Cambridge, was main speaker at the May 15 meeting held in the Continental Screw Co. His subject was "The role of statistical quality control in today's chemical industry."

A dinner for Mr. Renner at the New Bedford Hotel preceded the meeting. Martin S. Lindenberg of the Kalco Weaving Corp. presided at the business session. Certificates were awarded to 15 enrollees who successfully completed the basic quality control course arranged by Kenneth V. Chace of Berkshire-Hathaway, education chairman of the section.

CHICAGO On May 16, the last of four plant tours, which have been arranged by our plant tour committee, was made through the offices and plant of the Victor Adding Machine Co.

Prior to the tour, C. R. Strong, director of their quality control division, officially welcomed our group and briefly outlined the organizational structure, indicating quality control's relationship with other divisions. He also mentioned a few of Victor's products and touched lightly on their method of manufacture.

E. G. Freund, manager of quality control, outlined the part quality control techniques play in the manufacture and assembly of Victor products. Upon the completion of his address, Mr. Freund, assisted by members of engineering, sales and production control, guided our group through the plant.

Mr. Freund, the gentleman on the extreme right, is shown explaining an inspection instruction sheet and how it is used in conjunction with their classification of defects program and sampling procedure in the receiving inspection department. (The inspector shown is Mrs. Lorraine Johnson.)

On June 1, the section held its annual social evening at the Furniture Club of America. The dinner and entertainment was enjoyed by all members and their wives or feminine guests.

Dr. Mason Wescott showed slides of his trip to India and verbally put the group on the "Bombay Express" into the land of mystery and quaint customs.

In line with a program of mystery and intrigue, Bob Lace performed feats of magic proving the old axiom of the hand being quicker than the eye. Many thanks to Bob Tenney for arranging such an enjoyable evening.

CORNING -ELMIRA The final meeting of the season was held on May 23 in the Club Room of the Corning Glass Center in Corning, N. Y. A very successful "management night" was held as top management officials in the Bath-Corning-Elmira areas heard Dr. J. M. Juran speak on "Management to get better quality at lower cost." Dr. Juran's fine talk was heard by management personnel from Mercury Aircraft, Westinghouse Electric, Commercial Screw, Corning Glass Works, Hardinge Bros., American LaFrance, Morse Chain, G.L.F. Exchange, Eclipse Machine, Ingersoll Rand, Cornell University, and American Bridge Works.

(Continued on page 22)

for better

ASQC has

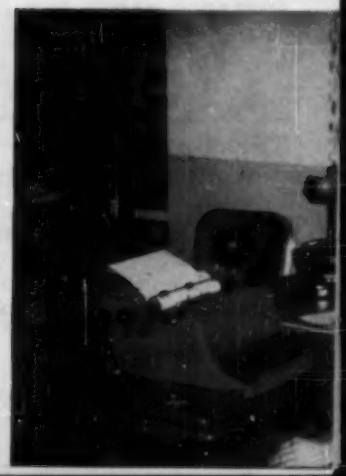
George Foster, managing editor of IQC, is already well known to many ASQC members, having served ASQC in this capacity since August, 1952.

NEW METHODS..

Membership records are now being kept on punch cards through the facilities of Workman Service, Inc. of Chicago, Ill. The transition to tab records, begun late in March, has now been completed. Mailing of this issue was made from labels prepared by the new system.

Publication of IQC involves a good many details and the girl who sees to it that everything functions when it should is Lee Megal, secretary to Mr. Foster. To handle the mechanical problems involved in getting each issue of IQC into your hands on time is Al Zingelman.

Gloria Spana spends most of her to IQC as well as processing or serves the office as receptionist.



ervice to members

.. A NEW STAFF

Jean Truettner, office manager, has her work cut out for her. Long known as "our gal Friday" to the Milwaukee Section, Jean is rapidly earning the same title in her service to ASQC. Plans also include hiring an administrative secretary as soon as possible to have charge of the Milwaukee office, to relieve your officers of much of their detail work, and to be responsible for the business transactions of IQC and the Annual Conventions.

..A NEW HOME

Room 6197 Plankinton Bldg.
161 W. Wisconsin Ave.
Milwaukee 3, Wis.

The time-consuming problems in the office hinge on the accurate maintenance of the membership records. Pat Meyer (left) and Kitty Gill (right), who handle this work now, will soon be joined by a third girl.

ocessing library subscriptions orders technical literature. Gloria also

(Continued from page 19)

This meeting concluded the initial year of the Corning-Elmira section, which has shown over a 200 percent increase in membership since it was officially made a section last July. From an original membership of 32, the section now boasts over 109 members. In addition to this large membership gain, the section has also sponsored a three month quality control course which attracted over 60 people.

DANVILLE -SUNBURY The May meeting featured a tour of the Merck and Co. plant located in Danville, Pa. Refreshments were served in the plant cafeteria following the excellent tour.

DELAWARE The last regular meeting of the current season was held on May 3 at the De La Warr Hotel. It was a most interesting and lively meeting consisting of a panel discussion and question and answer period on the general subject of "Problems in plant application and maintenance of quality control."

W. J. (Bill) Chelgren served as moderator; J. F. (Fred) Verigan spoke briefly on the subject "Enlisting cooperation of direct supervision" and L. W. (Bud) Miller, pinch-hitting for Larry Steinhauer, spoke on "Policing an established quality control program." The audience of some 25 or 30 members and guests kept the panel members busy answering questions following these brief talks.

Immediately following dinner and preceding the panel discussion the annual business meeting of the section was held at which reports of the various officers and committee chairmen were presented.

Worthy of special mention at this time is the educational clinic conducted throughout the season by Hillman Harris, our new vice chairman and chairman of the program committee. This series of six lectures on some of the more fundamental concepts and procedures of SQC was well attended and represents a most worthwhile contribution to the activities of the section.

KANSAS CITY On the evening of May 9 the section met in the Cypress Room of the Muehlbach Brewery. Approximately 180 members, wives, and friends enjoyed a social hour and buffet supper prior to the business meeting. The business of the evening consisted of installation of officers who had been recently elected and the presentation of a film by the Muehlbach Co. on "Controlling the quality of beer."

LOS ANGELES At the May meeting of the section, Alan Hull of United Airlines described a system for determining maintenance requirements on airplanes that is well adaptable to any other type of equipment. The use of SQC techniques can effect great savings in this field. William Hitt of Douglas Aircraft Co., presented an interesting sound film on "Nondestructive tests in aircraft maintenance."

MEMPHIS A panel discussion of OR problems in quality control was the feature of the May 29 meeting held in the Community Room of the Leader Federal Savings and Loan Association. The panel was composed of Edward P. McMahan, Douglas W. Ferris, Eric Dudley Roberson, and H. B. Green.

MILWAUKEE A meeting for the discussion of problems brought up by the membership was held on May 21 at the Stratford Hotel. The panel members who answered the questions were: Bill Golomski, Marquette University; Jim Barrabee, International Harvester; Larry Neuman, Miller Brewing Co.; Evan Scheele, Marquette University; (all of Milwaukee); and Tony Spelich of Waukesha Motors, Waukesha, Wis.

NEW HAMPSHIRE On May 23 we held our annual dinner meeting at the Moody Hotel, Claremont. Our speaker was Brent Jacob, Jr., chief industrial engineer at Chrysler. Mr. Jacob's subject was "Machine tool capabilities." A plant tour of the Job Manufacturing Co., Claremont, preceded the meeting. Twenty three companies were represented by the

SCHEDULE OF MEETINGS 1956-57

1956			
July	20	Operating Committee	New York, N. Y.
Sept.	14	Operating Committee	Cincinnati, Ohio
Sept.	15	Executive Committee	Cincinnati, Ohio
Nov.	15	Operating Committee	Milwaukee, Wis.
Nov.	16	Executive Committee	Milwaukee, Wis.
Nov.	17	Board of Directors	Milwaukee, Wis.
1957			
Feb.	1	Operating Committee	New York, N. Y.
Apr.	12	Operating Committee	Chicago, Ill.
Apr.	13	Executive Committee	Chicago, Ill.
May	22	Operating Committee	11th Annual Convention
May	23	Executive Committee	Detroit, Mich.
May	24	Board of Directors	

Items for the agenda for any meeting should be in the hands of the Executive Secretary two weeks before the date of the meeting.

TEN-TIMERS

A unique and interesting feature of this year's banquet program was achieved when, in the course of his introductory remarks, President Bender invited to rise for recognition, all those present at the banquet who had an unbroken record of having attended each of the ten annual banquets of the Society.

So far as is known no official count or record was made of those responding to this invitation. It has since occurred to several of these ten-timers that it would be appropriate to document the identity of this group.

Accordingly, all those who have an unbroken record of attendance at all first ten annual banquets of ASQC are hereby invited—indeed urged—to register this fact with Wade R. Weaver, Republic Steel Corporation, Cleveland 1, Ohio.

Such a group could conceivably be of special and distinguished service to the Society on an informal basis during at least the next ten years. Membership in this group is a singular distinction worthy of more than a passing interest. Therefore, if you *are* a ten-timer at ASQC banquet sessions, will you please so notify Wade Weaver at once!

105 members and guests in attendance. It was the largest meeting held in our area on a technical subject. The area machine tool companies gave us complete support by sending their top technical men. The comments afterwards were enthusiastic.

NEW HAVEN W. A. (Bill) MacCrehan, quality manager, Bendix Radio Div., Towson, Md., addressed the final dinner meeting held on May 8 at the Savoy in Hamden, Conn. Bill's topic was "A vendor quality evaluation program in action." His presentation was well received and stimulated an excellent discussion period afterwards.

The installation of new officers for the 1956-57 year was also part of the program.

An organization meeting of the new executive committee in conjunction with the retiring executive committee was held at the Greist Mfg. Co. plant in New Haven on May 22. Programs for next season were discussed at length and new committee chairmen were apprised of their duties by G. J. McVay, section chairman for 1956-57.

PITTSBURGH E. F. Ormsby, district applied science representative of IBM Corp., Cleveland, Ohio, presented "The application of automatic computing machines to business and industrial problems" at the May 22 meeting held at the Gateway Plaza Restaurant. Mr. Ormsby's talk proved to be one of extreme interest to those members in attendance.

SAN FRANCISCO BAY AREA Monday, May 7, marked the dinner meeting of the section. Following dinner, a "panel of experts," pre-selected from the membership, displayed their resourcefulness as they weighted problems and questions put to them by the attendees and discussed ways and means toward solution of the same. Enthusiasm ran high and the meeting adjourned late.

SOUTH BEND -MISHAWAKA On May 17 at a dinner meeting, William A. MacCrehan, Jr., quality engineer of Bendix Radio Div., Bendix Aviation Corp., Towson, Md., gave a dynamic address on "Reliability, a quality challenge to consumer-vendor relations." He told the group that "the challenge of good consumer-vendor relations is a vital link in the progress of industry on its march forward to exacting product improvement."

STATE UNIVERSITY OF IOWA The annual meeting of the section took place Thursday and Friday, May 24-25. Lloyd Knowler's welcoming remarks were directed to re-emphasizing the use of the basic quality control techniques.

R. W. Boeke, chief inspector, Deere and Co., Ottumwa Works, presented a problem in correlation. His talk illustrated how relationship between two costs could be determined by linear correlation.

Lloyd Knowler spoke on further applications of correlation. His presentation dealt with a simplified method of calculating the correlation coefficient.

Some impressions of education in our country today were briefly discussed in an address presented by Dean Dawson.

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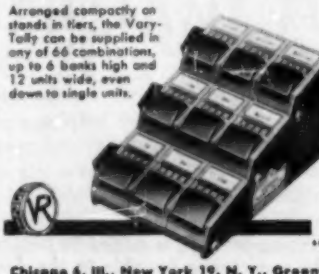

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56-2

William Vogel from the Rock Island Arsenal, Rock Island, Ill., presented a paper on mathematical programming. His talk dealt with the reduction of all possible solutions to a problem to the best possible solution by mathematical methods. Mr. Vogel estimates five to ten percent savings can be realized by the use of mathematical programming.

The drawing for door prizes resulted in the following winners: 1st prize—Eugene Lawson, Philco Corp., Dexter Div.; 2nd prize—Curtis Kurtz, John Deere Tractor; 3rd prize—James Logsdon, Sheaffer Pen Co. In addition to the regular door prizes, member Wayne Biklen of the American Safety Razor Corp., provided additional prizes, as well as razor blades for the group.

The adjournment of the meeting concluded Iowa section activities for the season.

TORONTO May 16 saw the wind up of the section general meeting with a very delightful Ladies Night. Approximately 30 members and their wives enjoyed a visit to the General Electric Lighting Institute on Dufferin St. where many amazing effects of using proper lighting were demonstrated to the delight of everyone. After which the evening closed with the serving of coffee, sandwiches, and cookies.

On Apr. 24 the 1956-57 officers and committee chairmen met at the Canadian General Electric Ward St. works. This meeting was held to acquaint new officers and committee men with one another, and to get the 1956-57 program rolling.

The second meeting of officers and committee men was held May 22 at Photo Engravers & Electrotypers Ltd.,

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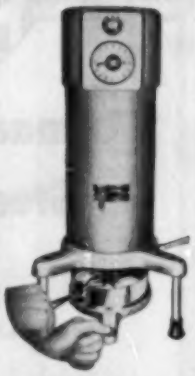

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Liquid Wax	5	250	15
Yeast	50	200	15
Licorice Extract	5	225	30
Pig Meal	25	250	25
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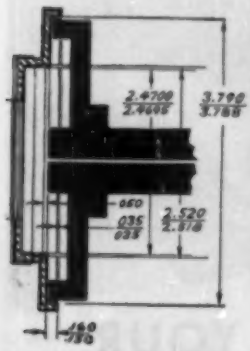

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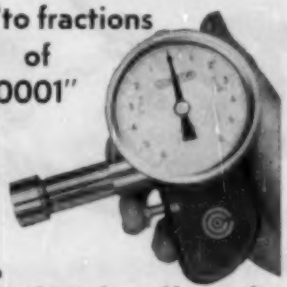

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GET THE FULL FACTS — REQUEST BULLETIN 49

Etobicoke. Our new chairman, J. D. Gardiner, spoke on the necessity of increasing membership, attendance and publicity.

TRENTON The section completed the season with two plant tours. On May 5 the group went through the Fairless Works of U. S. Steel Corp. and on May 9 the Wire & Rope Div. of U. S. Steel was visited. The tours were conducted by Sam Prellwitz and John Marks, both of U. S. Steel Corp.

WESTERN MASSACHUSETTS On May 15 the section celebrated its Tenth Anniversary with a banquet at the Sheraton-Kimball Hotel in Springfield, Mass. Seven of the ten past presidents were honored and a movie depicting the wonders achieved in research chemistry called "The world that nature forgot" was shown. There were 55 in attendance at this meeting.

On May 31 the basic course in statistical quality control came to an end. Thirty students from local industry completed the course which was jointly sponsored by the section and the Massachusetts University Extension.

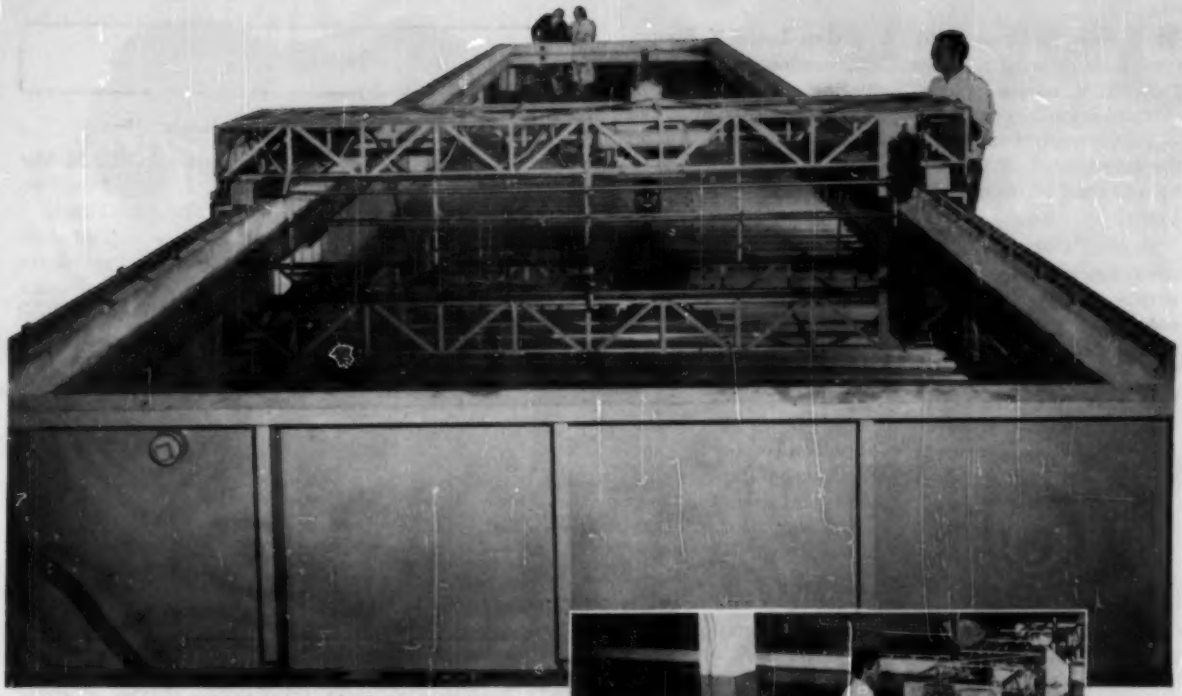
WORCESTER Andrew B. Holmstrom, vice president of Norton Co., spoke at the dinner meeting of the section held on May 17. The subject of his talk was "Managements viewpoint of quality control" and was very well presented.

"AS YE SOW . . ."

11TH MIDWEST QC CONFERENCE OCTOBER 11-12 The 11th Midwest Quality Control Conference will be held in Minneapolis this Oct. 11-12. The Minnesota section and the Midwest Conference Board are making plans so that your stay in Minneapolis will be pleasurable and educational. The chairman of the event will be Gayle McElrath, and its theme is "What's new in quality control?" Mr. McElrath's committee is well along in the planning of the conference, and a very interesting and helpful program has already been set up. For further information on the conference write to: Richard Keefe, 2620 McNair Drive, Minneapolis 22, Minn.

WESTERN REGIONAL CONFERENCE AUGUST 20-21 J. L. Atwood, president of North American Aviation, will speak on the future of aviation at the Western Regional ASQC Conference Banquet on Monday, Aug. 20. As president of one of the largest aircraft manufacturing companies, Mr. Atwood is well versed in the direction and aspirations of the aviation field at this time, and his remarks will be of interest to all, even if his listeners are not in the aircraft field.

The conference will be held at the Statler Hotel, Los Angeles on August 20 and 21. The program starts with registration at 8 a.m. on Aug. 20 and continues until 4:30 p.m. on Tuesday, Aug. 21. Registration fee which includes the price of the two luncheons, the banquet Monday night and a copy of the proceedings, containing copies of all 34 papers, is only $20.00.



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Luncheon speakers will be Maj. Gen. Leslie E. Simon, retired, director of research, Carborundum Co., Niagara Falls, N. Y. whose topic is "Initiating quality control in existing organizations." General Simon has been active in quality control since 1929 and has pioneered its use by the government. Prior to his retirement from the service he was chief of research & development in the ordnance Corps.

Tuesday's luncheon will feature Dr. Lloyd Knowler, chairman, mathematics and astronomy department, University of Iowa, Iowa City, Iowa. Dr. Knowler has been one of the pioneers in ASQC from its inception, specializing in the mathematics end of quality control, and has done much consultant and education work in that field.

Dr. Knowler and General Simon will also participate in the U.C.L.A. course in quality control to be given Aug. 6-17, the two weeks prior to the conference.

In addition to these distinguished gentlemen the list of Conference participants includes Leon Bass, General Electric Co., national vice president; Howard L. Jones, general supervisor, Illinois Bell Telephone Co.; A. Needham, vice president, Loud Machine Works, Los Angeles; Dale Lobsinger, United Airlines, Inc., national president of ASQC for 1956-57; and Col. C. F. Danberg, chief, aircraft division, directorate of Procurement and Products, Wright-Patterson Air Force Base, Ohio.

For registration forms and further information, contact Irving Quart, 12720 Welby Way, North Hollywood, Calif., RYan 1-8471, Ext. 330.

DIVISIONS

Administrative Applications Division

The Division is planning participation in the Middle Atlantic Conference to be held in Philadelphia on Feb. 15 and 16, 1957, at the Benjamin Franklin Hotel.

Early in 1957 the Division will sponsor a joint conference in Chicago with the Systems and Procedures Association. Committee chairmen for this conference have been appointed by the general chairman, Paul Robert. The first conference planning meeting was held Friday afternoon, June 8, following the annual meeting of the Division held in conjunction with the 10th Annual ASQC Convention at Montreal.

Aircraft Division

Dorian Shainin, chairman of the Aircraft Division Nominating Committee, has reported the selection of nominees for 1956-57 officers. They are: chairman—H. B. Epstein, chief of procurement control, Chance Vought Aircraft, Dallas, Texas; vice chairman— R. D. Humphries, inspection supervisor, Cessna Aircraft Co., Wichita, Kans.; secretary—H. Earle Moore, quality control manager, McDonnell Aircraft Corp., St. Louis, Mo.; treasurer—E. F. Taylor, quality control supervisor, North American Aviation, Inc., Columbus, Ohio.

The Division has enjoyed a tremendous growth in membership during the past year. Sixty seven members

QUALITY CONTROL ENGINEERS

A new fully integrated quality control program is being set up at Unit Plant which is manufacturing chrome plated brass plumbing fittings. Under the direction of the Quality Control Engineering Supervision these Engineers will plan all inspection procedures, tests and experiments for defect prevention, quality assurance procedures (audit and check inspection), the application of statistical tests, and the planning of executive reports on quality. Applicants must have had engineering training or equivalent experience in the field of modern industrial quality control. Kindly furnish resume of personal data and experience, including snapshot if available. Address replies to Personnel Administrator, American-Standard, 1541 South Seventh Street, Louisville 8, Kentucky.

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were listed on the roster last year when the Aircraft Technical Committee petitioned the National Office for division status during the national convention. A report on membership as of Apr. 15 listed 458 members with the division represented in every district of the Society.

SIGNIFICANT DIFFERENCES

Congratulations to Neil Zimmerman, vice president of the Birmingham section, on his recent promotion to manager of the Birmingham plant of the Line Material Co., a subsidiary of McGraw Electric Co.

The Danville-Sunbury section announced the promotion of immediate past chairman Fred Bernstine to supervisor of quality control at Montoursville plant of Sylvania Electric Products, Inc., and the transfer of Richard Thome from the chemical control department to the safety department as an assistant safety engineer at the Merck and Co. plant, Danville, Pa.

Fred W. Rohde, Kansas City section vice chairman and quality control engineer at Westinghouse Electric Corp., A.G.T. Division, recently attended a symposium at Institute Dr. Foerster, Reutlingen, Germany. Mr. Rohde was the representative at large for the Aircraft Industries Association by virtue of being National Chairman of the quality control committee of the Association. At the symposium he presented a resumé of "Modern non-destructive methods used in aircraft and aircraft engine manufacture."

James M. McFann, senior member and charter member of the South Bend-Mishawaka section, has recently moved to Ontario, Calif. having accepted a position with the Kaiser Steel Co. as a senior industrial engineer. Jim's absence will be felt by his many friends back home who wish him well in his new endeavor.

R. L. Murray, Tennessee section chairman, has accepted a position as designer with Rutherford Garment Co., Rutherford.

Dale A. Cue, a member of the quality control staff of the A. O. Smith Corp. for the past two and one-half years, has been appointed assistant to the director of quality as recently announced by R. M. Hislop, who heads the quality control program. Mr. Cue, senior member of the Milwaukee section, will be responsible for reviewing all divisional quality problems and will assist in quality control training of Smith personnel.

Henry I. Matosoff, formerly of Firestone Tire & Rubber Co. and member of the Los Angeles section, has been appointed quality control manager of Quikset Locks, Inc., at Anaheim, Calif.

G. J. McVay, chairman of the New Haven section, has been promoted to the position of production and quality manager of the Armstrong Rubber Co., New Haven, Conn. E. O. Edelman, former membership chairman, has been promoted to assistant factory manager of the same company.

Claude Elliott Adair

It was with deep shock and a personal sense of loss that each of us who knew Claude E. Adair learned of his death in the commercial airline accident at Pittsburgh, the 1st day of April.

Charter member of the Society and president of the Indianapolis section, quality control was second only to his devotion to his family. It was said of him, "He was the most courageous person I ever knew!" When such handicaps as cataracts and illness came along, personal qualities of drive and determination enabled him to press on to greater accomplishments. An original thinker, Claude never failed to give credit to others for their ideas. He still mentioned "Joe" Juran's help in the early days at Western Electric in Chicago.

In his classes Claude showed his students they could have the engineering approach whatever their work assignment. This simple philosophy, coupled with the warmth and enthusiasm with which he made himself available to assist any and all, elevated him far beyond replacement both in his job and the hearts of his associates.

Claude Elliott Adair was born in Chicago in 1907. He attended the University of Detroit. His enthusiasms brought him honors in a wide range of activity from football to opera.

Most of his professional life was spent with the Western Electric Company at Chicago and Indianapolis. Assigned to the inspection division, he developed an interest in quality control that he carried far beyond the call of duty. After many years in the line organization as group leader and supervisor, he transferred to inspection methods development work in the engineering division. Here he played an important part in setting up a training course for engineers and supervisors to give them a working knowledge of process control, acceptance sampling and administration of controls for quality. At the time of his death he was enroute to the final committee meeting for publication of a comprehensive quality control handbook to be used at all Western Electric locations.

Surviving are his widow, Katherine M.; a daughter, Penny, age 14; and a son, Tommy, age 10.

The Annual Clinic of the Indianapolis Section, ASQC, into which he put so much of himself will be a living memorial to the spirit of Claude Adair.

—HMH

REPORT OF THE TENTH ANNUAL CONVENTION

Montreal, Quebec, June 6, 7, 8

Civic Reception

Atop Mount Royal at the Chalet, Mayor Drapeau of Montreal staged a long-to-be-talked-about civic reception for some 650 early registrants at the convention. The beautiful view, albeit a bit misty, plus the abundance of fine food and drink and a wonderful dance orchestra combined to make a most warm welcome for the appreciative conventioneers.

The Sessions

The following morning saw the sessions get underway and these proceeded at a pace of eight at a time until Friday noon when the last eight of the more than 90 speakers finished giving their papers. As with previous conventions, the sessions covered all aspects of SQC and then some. Papers ranged from fundamental concepts to the very latest advances. The bill of fare was so varied as to suit the widest of tastes and needs.

The Attendance

Over 1,000 advance registrations had been received up to the opening date of the Convention. The first day saw 1,350 registered delegates in attendance. By Thursday noon, this figure had climbed to 1,400, with the final tabulation Friday reaching 1,512.

Facilities

Compactness was the keynote with regard to facilities. Everything was on one floor and under one roof without the slightest overcrowding in the Palais du Commerce. This included all the sessions, luncheons, exhibits, and administration.

Luncheons

Mr. A. Forsyth, president of Dominion Steel and Coal Company, was introduced at Wednesday's luncheon by Mr. S. M. Finlayson, president of the Canadian Marconi Company. Mr. Forsyth's talk contained just the appropriate amount of subtle humor, but his subject was most serious and well presented. He spoke particularly about "quality" in education and the dangers in our current educational trends of lowering standards to enable turning out a larger "quantity" of technologists. While not advocating a complete return to the limited scope of the "three R's", Mr. Forsyth expressed the very reasonable opinion that much of the extra-curricular fields in today's methods could and should be eliminated. In particular he suggested that those educators responsible for courses which become known to all as "snaps," "ponies," or what have you, would do well to re-evaluate their aims with the objective of improving over-all educational quality.

Luncheon on Thursday was highlighted by the presence of seven past presidents of the Society at the head table. These were:

George D. Edwards
Ralph E. Wareham
Wade R. Weaver
Simon Collier
Alfred L. Davis
Paul A. Robert
Arthur A. Bender, Jr.

Following the final technical sessions Friday morning, each of the Society's six divisions held its own luncheon and annual meeting for members at the Sheraton-Mount Royal Hotel.

Annual Meeting

The Annual Meeting of ASQC was held in Room C at the Palais du Commerce at 4:30 pm Wednesday.

Detailed annual reports in printed form were available for all members attending the meeting who desired them and brief oral reports were presented by the various officers. Prof. Mason E. Wescott and Leon Bass dis-

ENGINEERS

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Must possess thorough knowledge of Television-Radio theory and Tuner Testing plus practical industry experience with specialization in Tuner Testing and Inspection. Engineering degree plus one year's experience or technical school graduate plus 3 years' experience in the field.

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cussed the status of IQC; Ervin E. Schiesel presented the financial status and mentioned particularly the transfer of the Society's securities portfolio to a new custodian in New York; C. E. Fisher reported to the members on the consolidation move of the Society's offices at Milwaukee.

Official announcement of the election of the officers for 1956-57, reported under the Annual Banquet, concluded the business of the Annual Meeting.

Social Evening

The Champlain Room of the Sheraton-Mount Royal Hotel was the scene of a most enjoyable get-together of several hundred of those delegates who were not exploring "the Paris of North America." There was a copious supply of liquid refreshment, plus very danceable music interlaced with entertaining Dixieland Jazz by a good orchestra.

Augmenting the scheduled music supplied by the orchestra was a little unscheduled violin playing by a delegate, who won himself quite a following of song-fest addicts in between dance sets. Many acquaintances were renewed, refreshed, and otherwise nurtured at this very fine get-together.

Meet the new Executive Directors. Left to right they are: front row, Clarence R. Burdick, Harry G. Romig, D. G. Browne; back row, Paul S. Olmstead and Henry J. Becker.

QUALITY CONTROL ENGINEER

A new fully integrated quality control program is being set up in a ceramic plant, which is manufacturing sanitary ware. This man will plan all inspection procedures, tests and experiments for defect prevention, quality assurance procedures, the application of statistical tests, and the planning of executive reports on quality. Applicants must have had engineering training or equivalent experience in the field of modern industrial quality control. Kindly furnish resume of personal data and experience, including snapshot if available. Address replies to Personnel Administrator, American-Standard, P. O. Box 8237, New Orleans 22, Louisiana.

Ladies' Program

At 9:00 am each day, a most important hour—The Coffee Hour—began. During this time, groups for shopping sorties were formed; notes were compared as to experiences and possibilities for dining and shopping. Planning for that wholesale depletion of funds began here, gentlemen!

An extremely entertaining fashion discussion, handled by the famous Miss Doreen Day, was a highlight of the Ladies' Luncheon on Wednesday.

On Thursday, two tours were available. One was through the very efficient food preparation facilities and groceteria warehouse of Steinberg's, a giant Quebec food chain store. The second was a bus tour of the Convention City itself which was thoroughly enjoyed by a very pleased group.

The Weather

A dull, cloudy day greeted advance delegates on Tuesday, but the weatherman forecast and supplied three of the most beautiful, warm, sunny days for the actual convention.

Advantage was taken of the fine weather in numerous small ways; e. g., after lunch each day, large numbers emerged from the Palais to sun themselves at the front entrance. Delegates could be seen going for strolls in the balmy weather at all hours of the day—a welcome respite from some of the heavier sessions.

Junior Past President Arthur Bender, Jr. (right) presents the gavel of office to newly elected President Dale L. Lobsinger.

Annual Banquet

In the Ballroom of the Sheraton-Mount Royal on Thursday evening June 8, the Annual Banquet was held. The National Anthems of both Canada and the United States were played, and another successful banquet was under way. A very delicious roast beef dinner was served to an overflow crowd. The meal was capped by a spectacular dessert of flaming Baked Alaska and petit-fors.

Leading off the program, President Arthur Bender, in the course of his introductory remarks, noted the occasion of ASQC's Tenth Anniversary year and took the opportunity to invite those members who had an unbroken record of attendance at all the ten Annual Banquets to stand for recognition of their signal achievement.* Following this President Bender presented to the members a brief and most interesting résumé of the progress made by ASQC during the year just past.

Next, seventeen representatives of the European Productivity Administration organization who are on tour to study North American teaching practices in SQC were welcomed to the convention as guests of ASQC by President Bender. Acting as spokesman for the group, Mr. Charles S. Smith of England responded to Mr. Bender's welcome and provided one of the entertaining highlights of the evening. If there is such a thing as typically dry British wit, Mr. Smith's remarks personified it. Observing that our convention was being held in Montreal and that Canada is a part of the British Commonwealth of Nations, Mr. Smith concluded that this was the first time in his experience when he was simultaneously a guest and a host.

Mr. Smith's remarks of thanks were followed by the presentation of the Tenth Anniversary Award. This competition was established only for this year to honor the section making the most progress in membership growth during the year. Chairman R. E. Nichols accepted the award for the South Bend-Mishawaka Section which was the recipient of this special award.

Presentation of the Saddorris Award for Section Management was made to the Birmingham Section, the 1955-56 winner. Neil Zimmerman, chairman, accepted the award on behalf of the section, which not only had the highest total score but also scored highest in the following individual categories of the competition:

Membership
Attendance
Publications
Publicity
Organization of the Year's Program
Meeting Notices and Reports
Conferences and Special Meetings
Educational Program Activities
Special Activities and Scrap Book

Birmingham was given a close battle, however, by four sections which obtained total points within 70 percent of the winning total. The Corning-Elmira and the Southern Connecticut Sections were the second and third place winners; Toronto and Michigan Sections are Master Sections for 1956-57.

In recognition and appreciation for its work in conducting the Tenth Annual Convention, President Bender presented a citation of the ASQC Board of Directors to the Montreal Section. The citation was accepted for the section by the general chairman, B. H. Lloyd.

The 1955 Brumbaugh Award, consisting of a citation and $50 cash award, was made to Prof. Ralph Allan Bradley for his article, "Some notes of the theory and application of rank order statistics," which appeared in the February and March issues of Volume XI of IQC, Nos. 5 and 6.

President Bender then introduced Mr. Harold F. Dodge who was sponsor for the 1955 Shewhart Medalist. The text of Mr. Dodge's sponsoring remarks follows:

*Sponsor's Remarks on the Award of the Shewhart Medal to Dr. William Edwards Deming**

President Bender, Members of the American Society for Quality Control, Honored Guests:

Before presenting to you the Medalist for the year 1955, let me give a brief review of the background of the Shewhart Medal.

In June of 1947 the Board of Directors of the American Society for Quality Control voted to establish the Shewhart Medal to honor individuals who have made outstanding contributions to the cause of quality control. Each year the responsibility of selecting a medalist rests with a special committee designated the Shewhart Medal Committee, which consists of nine members, three appointed each year for a three-year term. The Chairman of the Shewhart Medal Committee invites all National Directors of the Society in conjunction with Section Officers to submit nominations for the award. The National Directors are advised to consider eligible persons both here and abroad, nonmem-

*See special announcement, page 22.

**The full text of Dr. Deming's address appears on page 12 of this issue.*

Among the delegates at the convention was this group of representatives of the European Productivity Administration organization who are on tour in North America studying SQC teaching practices. Seated, left to right: Kurt Stange, Berlin-Charlottenburg, Germany; Pierre H. Ferignac, Paris VII, France; Paul C. Clifford, Montclair State Teachers College, Upper Montclair, N. J.; Annamaria Restelli, Milano, Italy; Charles S. Smith, Leicester, England; Jean A. Teghem, Brussels, Belgium; Jaime da Cruz C. Ferreira, Lisboa, Portugal; Alf R. Hernes, Oslo, Norway. Standing, left to right: Helmut H. Woerner, Frankfurt/Main, Germany; Victor J. Van Baelen, Tirlemont, Belgium; Christian K. Nissen, Trondheim, Norway; N. E. Philpot, project manager, International Cooperation Administration; Hans K. Brons, Copenhagen, Denmark; Soren A. Aggebo, Aarhus, Denmark; Maren L. Wijvekate, The Hague, Netherlands; Peter Slors, Almelo, Holland; Rolf Dietrichson, Trondheim, Norway; Salomon S. Grynszpan, Paris, France.

bers as well as members of the Society. At the same time, the Chairman of the Medal Committee invites the committee members to make nominations. All of these names are then formally considered by the Committee.

Factors that are given special consideration in selecting the medalist are pioneering or contributions in the field of quality control, successful promotion and management of quality control programs, and service to the art and to the Society. Once the medalist has been selected, the Committee prepares a citation and arranges the presentation ceremonies. The decisions of the Committee are subject to review by the Executive Committee of the Society.

The medal bears the inscription "Awarded for Outstanding Leadership in the Field of Modern Quality Control." Its design in reverse portrays a micrometer emblazoned with a control chart, signifying the taming of unwanted manufacturing variations by the art of quality control. The obverse presents a striking likeness of Dr. Shewhart, a truly distinguished work of art by the artist Robert Weinman. Both the medal and a certificate bearing the citation are presented at the annual meeting of the Society.

Now—to proceed to the matter of introducing the 1955 Medalist. The Shewhart Medal Committee, consisting of Messrs. Frederick R. Bailey, Leslie S. Eichelberger, Frank E. Grubbs, Edwin C. Harrington, Jr., Charles J. Hudson, B. H. Lloyd, Edwin G. Olds and myself, under the chairmanship of Frederick J. Halton, Jr., has accorded me the privilege of presenting the man selected as the 1955 Shewhart Medalist: Dr. William Edwards Deming—familiarly known to many of us as Ed. I am deeply grateful for this honor. The official citation reads as follows:

"The Shewhart Medal, established by the American Society for Quality Control for outstanding leadership in the field of modern quality control, awarded to William Edwards Deming for the year 1955 in recognition of his many contributions to the science, and to the art of application, of statistical quality control; his profound influence as a pioneer in teaching the methods of quality control and in developing standards for their utilization; and his international achievements in spreading the quality control philosophy and in promoting the use of statistical methods in industry. As a teacher, author, consultant, and friend, he has given unforgettable help and inspiration to members of The American Society for Quality Control."

Dr. Deming is a distinguished statistician whose contributions to the quality control field have extended over many years. He received his Bachelor's Degree in E.E. from the University of Wyoming in 1922, his M.S. from the University of Colorado in 1924, and his Ph.D. from Yale University in 1928. During these early

President Bender presents the special 10th Anniversary Award. R. E. Nichols accepts the award on behalf of the South Bend-Mishawaka section.

The winner of the Saddoris Award for Section Management for 1955 was the Birmingham Section. Neil Zimmerman receives the award from President Bender.

years he taught engineering and physics. Then, for a period of over 20 years, he was associated with certain branches of the government—the Department of Agriculture, the Bureau of Census, and the Bureau of the Budget. As Head of the Department of Mathematics and Statistics of the Graduate School of the Department of Agriculture, he was responsible for inviting Dr. Shewhart to lecture there in 1938. Shewhart's four lectures were published in book form as **Statistical Method from the Viewpoint of Quality Control,** with the editorial assistance of Dr. Deming. From this point on Dr. Deming became actively associated with a number of programs relating to increased use of quality control techniques. He was one of the committee of five that prepared the American War Standards on Quality Control, Z1.1, Z1.2, and Z1.3 of the American Standards Association. It was in this area in 1941 and early 1942 that I first became closely associated with the Medalist and learned some things about precision of language, clarity of expression and the niceties of punctuation that I will never forget.

Eugene Grant points out that it was at Dr. Deming's suggestion that Stanford University gave their first intensive courses in statistical quality control in 1942. These courses served as a pattern for the subsequent courses given on a nationwide basis under OPRD sponsorship. Dr. Deming served on the staff of the first five courses of this type given by Stanford as well as on a number of the later OPRD courses. And as you know, the groups trained under this program later became the nucleus of the various sections of the American Society for Quality Control, formally organized in 1946.

Our Medalist is the author of many papers and articles and is particularly well known for his text **Some Theory of Sampling,** which was published in 1950 in the series known as the Wiley Publications in Statistics, of which Dr. Shewhart is editor. This book makes substantial theoretical contributions to the field of sampling and quality control.

Dr. Deming's list of attainments is much too long to attempt giving here. During his government service he made notable contributions to the advancement of statistics and to the elevation of statistical standards in government. He is a past president of the Institute of Mathematical Statistics and a past vice president of the American Statistical Association. I would estimate that, internationally, he is more widely known personally than any other member of our Society. He has lectured in many countries, served as a consultant on a number of projects abroad, represented the United States in international statistical meetings, and was largely responsible for starting the substantial statistical quality control activity now flourishing in Japan. In fact, Japan, instead of having a Shewhart Medal to honor contributions to statistical quality control, has a close counterpart in its Deming Prize.

Today Dr. Deming spends his time in three general areas – consulting, teaching in the Graduate School of Business Administration of New York University, and participating in technical work of professional societies. He combines the qualities of pioneer, teacher, author, lecturer, and missionary. It gives me great pleasure to present to you as a friend and ardent co-worker, Dr. William Edwards Deming.

Following the address of the Shewhart Medalist, President Bender presented the new officers and executive directors for 1956-57. The new officers are:

President:
Dale L. Lobsinger
Vice Presidents:
Leon Bass
C. E. Fisher
Ellis R. Ott
Ervin E. Schiesel
Executive Secretary:
L. S. Eichelberger
Treasurer:
J. Y. McClure

and the new executive directors are:

H. J. Becker
D. G. Browne
C. R. Burdick
P. S. Olmstead
H. G. Romig.

Exhibits

A vital part of this year's convention was the exhibit area in the Palais du Commerce.

A very fine booth and display was presented by the American Society for Quality Control. The Book Booth, as usual, was a great center of activities. An equally active center was the travel information booth by the Province of Quebec. Manufacturers who exhibited were: Bausch & Lomb Optical Co., Rochester, N. Y.; Bestec (Canada), Montreal, Quebec; Canadian Size Control Co., Ltd., Kingston, Ontario; Cleveland Grinding; Custom Scientific Instruments, Inc.; Electro Design; Elliott Service Co., Mount Vernon, N. Y.; The Fern Tool Co., Ltd., Montreal, Quebec; Hamilton Watch Co., Lancaster, Pa.; Hughes Aircraft Co., Culver City, Calif.; John Bertram & Sons (Jones & Lamson); Johnson Gage; Marchant Calculators, Inc., Oakland, Calif.; R. J. MacLeod & Co., Ltd., Quebec; Miles Reproducer Co., Inc.; Monroe Calculating Machine Co., Orange, N. J.; Parker Imports Reg'd., Montreal, Quebec; Pepsi Cola, Montreal, Quebec; Rudel Machinery Co., Ltd., Montreal, Quebec; Scott Testers, Inc., Providence, R. I.; Service Diamond Tool; Sperry Products, Inc., Danbury, Conn.

The 1955 Brumbaugh Award for the best article appearing in Vol. XI of IQC presented to Dr. Ralph Bradley by President Bender.

President Bender presents the Shewhart Medal to W. Edwards Deming, this year's medalist.

Montreal Committee

A convention report would indeed be incomplete without due recognition to the members of the host section—Montreal—who were responsible for the details of the most successful Tenth Annual Convention. The following are the various committee chairmen to whom go our sincere thanks:

B. H. Lloyd, general chairman
J. Bruce Leadbetter, vice chairman
Brant Bonner, vice chairman
A. P. Deacon, vice chairman
C. I. Taylor, accounting
L. H. Wedge, general arrangements
Roger Lessard, program arrangements
B. H. Steves, book booth
R. H. Peck, exhibits
J. B. Pringle, program
R. V. Ward, publicity
P. G. Macklem, reception
F. A. Gnaedinger, transactions
E. N. Beckett, registration

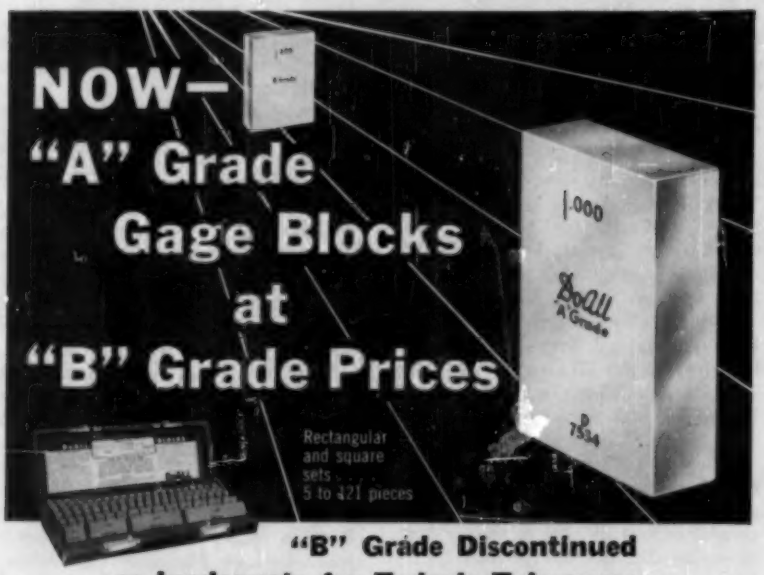
FUTURE CONVENTIONS

The next three annual conventions of ASQC have been scheduled as follows:

11th Detroit, Mich.
May 22, 23, 24, 1957

12th Boston, Mass.
May 26, 27, 28, 1958

13th Cleveland, Ohio
May 25, 26, 27, 1959



"B" Grade Discontinued as Inadequate for Today's Tolerances

Prevent measurement errors, save time, save money and pay no premium: DoALL "A" Grade gage blocks, with guaranteed tolerances of plus .000004, minus .000002 per inch of length are now available at "B" Grade gage block (± .000008) prices!

Every set accompanied by a Certified Inspection Report showing calibrated size of each block! Precise calibration made possible by guaranteed 0 to 0.09 RMS surface finish. Superior finish also eliminates abrading action . . . extends useful life of block. Exclusive "burr-proofing" of edges minimizes chance of damage.

Get the facts—find out why "B" grade blocks cannot do today's measurement job. Call your local DoALL Store or write:

FREE—New DoALL Gage Block Catalog listing square and rectangular gage block sets in "A", "AA" and new "AAA" grades. Set sizes range from 5 to 121 blocks. Accessories for assembling fixed or indicating gages. Write today!

FREE—"How to Be Your Own Bureau of Standards"—new 36 page manual on shop inspection and calibration of gage blocks—describes equipment and methods needed to inspect blocks for flatness and wear as well as for accurately calibrating your blocks. Call or write for your copy.

The DoALL Company, Des Plaines, Illinois
Machine Tools · Cutting Tools · Measuring Instruments · Tool Steel

The new Ultrasonic Bond Analyzer manufactured by **Allen B. DuMont Laboratories, Inc.**, 750 Bloomfield Ave., Clifton, N. J., will enable airframe, missile and helicopter manufacturers to test the strength of adhesive bond material without destruction of the unit under test. The ultrasonic bond analyzer consists of a sweeping oscillator and a barium-titanate transducer. It also incorporates a DuMont type 304-AR Cathode-ray Oscillograph and a type 302

What's

ROY A. WYLIE, *Editor*

Oscillograph-record camera. The crystal transducer applies ultrasonic stresses to the piece under test, and the instrument, through a method of coupling signals to-and-from the metal, receives responses which appear on the oscillograph in waveform. By reading the oscillograph patterns, flaws in the laminate can be identified. The equipment, developed by Stanford Research Institute under contract to Wright Field, weighs 125 lbs., is about 20x20x22 inches in size and consumes 250 watts. It has a maximum R-F power output on two watts in the range of 170-1500 KC.

* * *

The **A. M. DeLeo Engineering Corp.**, 18220 W. 7 Mile Rd., Detroit 19, Mich., have developed a flush pin gaging method that can be effectively applied to gaging and manufacturing tolerances as small as 0.001 inches. This is made possible through the use of a flush pin gage amplifier

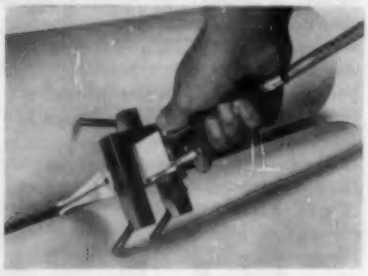
with a ratio of amplification of five to one. The amplifier consists of three high-precision hardened steel balls held by a retainer 120 degrees apart about the cone shaped end of a sliding pin. When activated by the gage contact, the balls move against the conical surface of the housing and against the cone shaped end of the sliding pin. This causes the cone pin to move upward by a ratio of five to one. This new ratio is the result of the geometrical relationship and accompanying trigonometric function between the angles of the two cones. Cone pin, ball retainer and balls are free to rotate, eliminating the possibility of spot wear.

★ ★ ★

Federal Products Corp., 1144 Eddy St., Providence 1, R. I., have announced an Air-Caliper Gage that provides direct measuring of a spacing between calender rolls so that the user may determine whether the rolls have been ground correctly all the way across. When calendering sheet plastic or similar materials, uneven calender rolls will produce un-

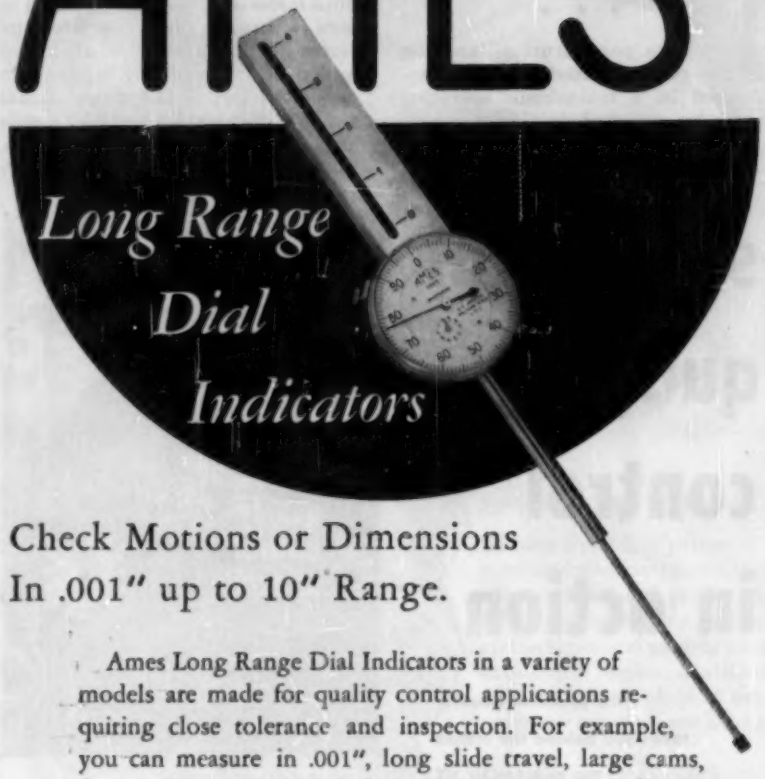
New?

even sheets. This can be seen immediately when the material is packaged in rolls because even very small imperfections, when multiplied by



the number of layers in the roll, become intolerable. Therefore, uniform spacing between the crowns for the entire width of the calender rolls becomes very critical. Federal Model A-149 P-1 is a portable caliper gage that contacts the rolls directly. The measurement is transferred from the caliper type contacts to an Air-Probe and any variation in space between rolls is shown on the Dimensionair

AMES



Check Motions or Dimensions
In .001" up to 10" Range.

Ames Long Range Dial Indicators in a variety of models are made for quality control applications requiring close tolerance and inspection. For example, you can measure in .001", long slide travel, large cams, deep recesses or other dimensions requiring indicator spindle travel of up to 10".

In addition, Ames Long Range models have all the advantages that are built into Ames regular indicators:— dials of large diameter; easy-to-read, widely spaced graduations; movable dials; replaceable contacts. All Ames Long Range indicators have count hands to indicate revolutions of the indicator hand. Those with box covered, rack guide have a slot in the cover graduated to register each inch of spindle movement.

Write today, sending your problem in long range measuring. Ames will be glad to suggest a solution. Be sure to include drawings and specifications — your answer will be back faster if you do.

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Dial which is connected to the Air-Probe through a plastic hose. Locating bars or legs assure that the Gage contacts penetrate to the proper depth and positioning is quick and positive. A master is used to set the calipers and a fine adjustment screw makes it possible to zero the Dimensionair quickly. No further setting is required.

★ ★ ★

A complete pore-structure analysis of any porous material can be performed in a ten-minute operating cycle by means of the new Aminco-Winslow Porosimeter, which measures sizes of pores ranging from 0.1 mm. to 0.06 microns and pore volumes as small as 0.0005 ml. at each pore diameter. This tool affords industry a portable and accurate means for analyzing pore structure of critical materials for numerous applications. The performance and quality of filters, battery separator plates, sintered metals, porous bearings, insulators, wood products and structural materials are directly related to pore structure. The porosimeter operates on the mercury-intrusion principle, is completely hydraulic (gas-free) and devoid of operational hazards. Pressure is applied by means of a manually-operated fluid pump. The instrument is 18½ x 8¾ x 10¾ inches high and weighs approximately 100 pounds. Details are given in Bulletin 2282 which is available from **American Instrument Co., Inc.**, Silver Spring, Md.

★ ★ ★

NEW LITERATURE

A new 36-page catalog describing Webber Gage Blocks and accessories is announced by Webber Gage Co., 12912 Triskett Road, Cleveland 11, Ohio. The catalog contains photographs, line drawings, charts and detailed descriptions of the company's complete line of linear and angular gage blocks and accessories, optical flats, interferometers and temperature meters. Four new, important additions to the Webber line are also included. In addition, the catalog features a section describing Webber's method of attaining millionth-of-an-inch accuracies, and another section on the care and handling of gage blocks.

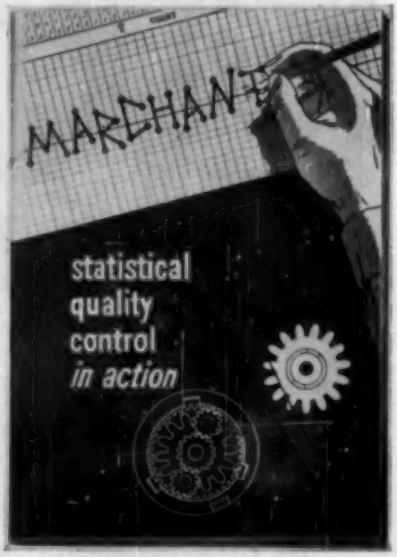
The Perkin-Elmer Corp., Norwalk, Conn., have available two new brochures of interest in the quality control field. One indicates the performance capabilities of the Model 21 Double Beam Infrared Spectrophotometer in the various spectral regions. The second describes the sampling accessories for infrared spectrometers. Some of the accessories described are the infrared microscope attachment, standard gas cells, 10 meter gas cell, KBr pellet technique accessories and microcell.

A new, illustrated booklet containing a complete selection of laboratory balances and weights has been issued by Central Scientific Co., 1700 Irving Park Rd., Chicago, Ill. The booklet provides laboratories with the opportunity to select the most suitable combination of balances, weights and accessories for solving virtually any weight determination problem. The booklet also contains the latest Government Weight Classifications and Tolerances.

The P. A. Sturtevant Co., Addison, Ill., manufacturers of torque wrenches and related products, have just completed a second edition of the *Torque Manual*. The second edition of this *Torque Manual* has been expanded and now includes additional torque application formulas. There are more suggested application illustrations. A new table shows screw torque data including minimum torsional strength tabulations, torque and tension relationship charts for high tensile and mild steel screws and torque conversion tables.

Pratt & Whitney Co., Inc., Charter Oak Blvd., West Hartford 1, Conn.,

statistical quality control in action



This practical booklet takes you behind the scenes at MARCHANT

Here is a graphic portrayal of practical Statistical Quality Control successfully at work in a large scale, precision manufacturing organization. Through the extensive use of photographs, charts, graphs, mathematical formulas, completed forms and other actual records, this 72-page booklet serves as an invaluable "case history" handbook for quality control executives and their staffs. By presenting an overall program and specific procedures covering many phases of manufacturing—assembly as well as production operations—this booklet provides practical guidance in approaching your own quality control problems.

"STATISTICAL QUALITY CONTROL IN ACTION" is available free of charge to interested companies and qualified individuals.

Just mail this coupon (attached to your business letterhead) to the address below, or write on company stationery.

← Mail coupon

MARCHANT CALCULATORS, INC.
Dept. C. OAKLAND 8, CALIFORNIA

have published a new illustrated bulletin covering their line of Go and Not Go Reversible Plug Gages. Both plain cylindrical and thread plug gages are covered.

A new 8-page catalog describing several electro-optical instruments for process control has been published by Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn. Described in the catalog are "Opti-Therm" infrared radiometers for remote temperature measurement, OptiTherm infrared detectors, The Barnes Industrial Process Refractometer for controlling the purity of process streams by continuous measurement of refractive index, and infrared sources and detector preamplifiers.

"Automation Gaging Systems and Standardized Control Units" is the name of a new catalog published by Federal Products Corp., 1144 Eddy St., Providence 1, R. I. The catalog explains the four gaging systems used for automatic control: electric, air electric, electronic, and air electronic and describes the components that make up each system. In addition the various types of control gaging for automation—such as, on the machine, after the machine, continuous process and several others—are fully covered.

POSITIONS AVAILABLE

Address all replies to box number references to: American Society for Quality Control Room 6197 Plankinton Bldg., 161 W. Wisconsin Ave., Milwaukee, Wis.

QUALITY CONTROL TRAINEE

Young man up to 30 years of age with industrial engineering type degree. National non-metal manufacturer located in eastern Pennsylvania. Work deals with quality control problems, development of machine capabilities, sampling techniques, etc. Reply sending details to Box 13N1 at the above address.

QUALITY CONTROL ENGINEER

With knowledge of gage design, trouble shooting and inspection methods used in mass production. Experience in statistical quality control desirable. Salary $7,000 to $8,000. Ronson Corp. of Pa., 250 Harris St., East Stroudsburg, Pa.

POSITIONS WANTED

Address all replies to box number references to: American Society for Quality Control Room 6197 Plankinton Bldg., 161 W. Wisconsin Ave., Milwaukee, Wis.

QUALITY CONTROL ENGINEER

Degree with experience in statistical and other quality control services. Presently employed supervising large textile quality control program. Desire relocating in north or northeast. Please reply to Box 13A1 at the above address.

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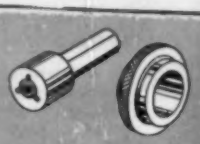

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QUALITY CONTROL MANAGER
Five years of aircraft manufacturing, three and one half years of military flying, two years of vocational teaching, two years of aircraft engine manufacturing, and three years of communications equipment manufacturing. The foregoing experience constitutes a background of staff, administrative and supervisory work. Two years as evening university instructor in SQC. Extensive background in gages, jigs, fixtures, tools and inspection equipment. Résumé furnished upon request. Please reply to Box 13A2 at the above address.

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To evaluate present inspection techniques employed in such areas as Machine Shop, Mechanical and Electrical Assembly, Receiving Inspection and the Processing Departments. Must evaluate Production Planning, operation call-outs, and assign classification of defects to each operation.

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To analyze, plan and review design of quality control test equipment and test methods to comply with advanced electronic and electromechanical specifications.

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For further details, you are invited to send your resume direct to MR. HOWARD A. GRIFFIN *at the address below.*

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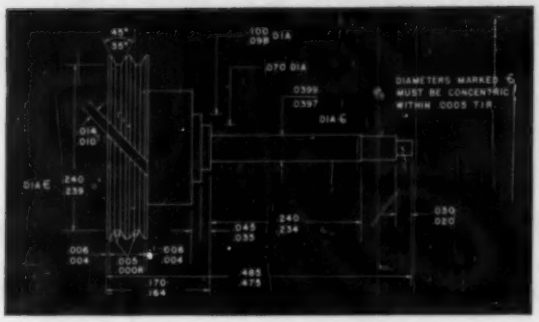
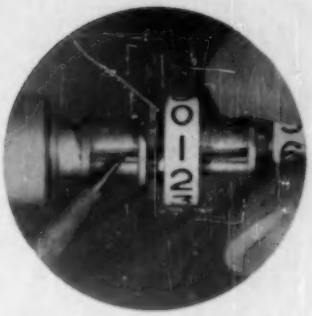


Inspection of incoming precision shafts took 10 to 15 minutes each by mechanical gaging—involved concentricity, diameters, shoulder locations, and other tough-to-measure dimensions to tolerances of .0002". Doing the work on a Kodak Contour Projector cut time to 2 to 3 minutes per shaft.



The problem was to check many small calculating machine parts averaging about 13 critical dimensions for each with shapes mostly complex. With carefully engineered mechanical gages, inspection time averaged 50 seconds each. Optical gaging on a Kodak Contour Projector brought the average down to 12 seconds.

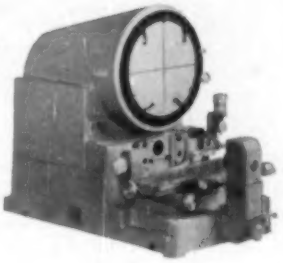
Spacing the parallelism of a special tuning condenser for electronic test equipment had to be held to very close tolerances. "Use of the Kodak Contour Projector," the company reports, "permits economical measurements of parallelism to an accuracy impossible to obtain by other methods."

On a flexible rubber-like part, rejects ran as high as 30%. By using a Kodak Contour Projector to measure the parts and then plotting results by statistical quality control methods, production changes were made that resulted in rejects dropping from 30% to less than ¼ of 1%. Optical gaging eliminated distortion of the part while gaging, and proved 4 to 5 times faster than usual methods.

One instrument inspects these varied parts

Here is another economy optical gaging can provide: switching from one part to a second part requires only a change of chart and fixture. You still use the same basic instrument. And with a Kodak Contour Projector, the variety of parts you can check is almost without limit. Here's why:

1. *Capacity*—Screen size on an optical comparator does not restrict the size of parts you can handle, for multiple-position fixtures allow the handling of parts larger than the screen itself. What's important is the staging area—and Kodak's unique relay lens provides uniform ample clearance regardless of magnification. The distortion-free image lets you measure anywhere on the viewing screen. The choice of lenses, of horizontal or vertical projection, and of surface or shadow illumination gives you the greatest possible flexibility.
2. *Ease of operation*—Kodak Contour Projectors are designed for maximum speed and minimum operator training. The bright screen image reduces fatigue, lets you use the instrument in normal room light. Images are erect and unreversed at all magnifications. Finger-tip controls are within convenient reach of the operator.
3. *Optical stability*—The adjustment-free optical elements on Kodak Contour Projectors eliminate the need for operator adjustments. Rigidly mounted lenses and mirrors maintain alignment and position. Rugged construction withstands rough and heavy use.



Whether you are now using optical gaging or just considering it, you should have a copy of the booklet, "Optical Gaging with Kodak Contour Projectors." It gives complete details on Kodak optical gaging equipment and how it can work for you. Write to *Special Products Sales Division.*

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This is why you need only ONE master!

This air gage system is basically different from that of other air gages. One side of this system—the measuring side — is *rigidly fixed.* There is no adjustment and measurements *cannot vary.* Hence, the gage *is linear* over its long range and *can be calibrated* and *set with a single master.* Because of this, the Dimensionair is an air gage of dependable stability. *It cannot drift . . . throughout its long range.*

The balancing side of the system has a *single* zero adjustment. This enables you to set the Dimensionair positively and instantly to zero, *with a single master.* Excess bits of dirt, oil or water *do not* affect the Dimensionair any more than they do other air gages. *But,* some gages are too *insensitive* to show up such failure.

If you are familiar with ordinary air gages requiring two masters, you'll appreciate the advantages of using *one* master. You *save half the cost of masters . . .* set the gage easily and simply . . . experience, for the first time, the feeling of *dependable, non-drifting,* precise measuring.

The Dimensionair's basic system enables it to be *combined directly* with electrical and electronic units as used with *Machine Control* and *Automatic Sorting Gages.* This obviates the accessory equipment required by other air gages and permits higher speeds, greater precision — with assured stability. It is much easier to set the gage to the spread between electrical contacts; e.g. the spread between the machine's fine feed and the finish feed. Adjusting to zero *does not* affect this spread setting.

Check these facts for yourself. Have a Dimensionair installed in your plant now.

Compare it with any other air gage you may already own or any you may wish to have brought in for comparison.

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1. **One master, only, required.**
2. **Constant, positive accuracy.** Balanced air system positively controlled. It can't drift.
3. **Dependable stability.** Unaffected by surges, or changes in air pressure.
4. **Linear, direct reading scale.** Not a "go" and "no go" gage. Positively controlled accuracy permits calibrated linear scale having graduations of **known value.**
5. **Longer range per magnification** .003" and .0015", on 2,500 to 1 and 5,000 to 1 respectively, takes care of 90% of gaging requirements and provides the following advantages:
   Greater Plug Clearance.
   Longer approach range.
   Longer gage head wear.
   Greater jet protection.
6. **Fast, easy setting.** Positive setting in ten seconds.
7. **Easiest to install.** Connect directly to air supply. Filter already attached. Pressure regulator assures ample protection — only 40 lbs. pressure required.
8. **Less maintenance.** Gage system better protected. Larger jets stay clean. Maintenance negligible if properly installed.
9. **Easily adaptable to special requirements.** May be combined with electrical and electronic units for **automatic gaging and machine control.**

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